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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3847**

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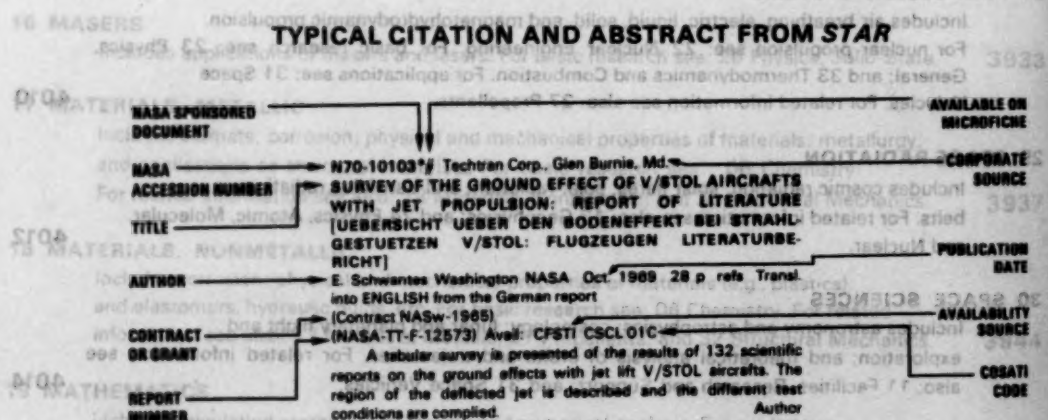
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Author

VOLUME 8 NUMBER 21 / NOVEMBER 8, 1970

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-37626# Sandia Corp., Albuquerque, N.Mex.
ANALYSIS OF THE ANGULAR MOTION OF MISSILES
Robert S. Eikenberry (Notre Dame Univ.) Feb. 1970 174 p refs Sponsored by AEC
(SC-CR-70-6051) Avail: CFSTI

Methods of analysis for wind tunnel and free flight missile angular motion data are developed. Included are procedures for obtaining both linear and nonlinear aerodynamic stability coefficients. Author

N70-37673# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AXIAL COMPRESSOR AIRFOILS FOR SUPERSONIC MACH NUMBERS Final Report
Richard M. Hearsey and Arthur J. Wennerstrom Mar. 1970 109 p refs
(AD-707144; ARL-70-0046) Avail: CFSTI CSCL 21/5

The report concerns axial compressor airfoils suitable for operation at supersonic Mach numbers. Two, relatively versatile camber-line shapes and a common thickness distribution are mathematically derived. One camber line is particularly appropriate for blades of continuously positive camber. The other is capable of defining J-blades, S-blades or a smooth transition between the two. A method is presented whereby the airfoils are specified on arbitrary axisymmetric streamsurfaces and then are accurately redetermined in Cartesian coordinates on planes normal to the stacking axis. A computer program implementing these calculations is presented and described in detail. This program determines the coordinates, calculates section properties, and provides direct plots for both coordinate systems. Author (TAB)

N70-37688# Sandia Labs., Livermore, Calif. Advanced Development Div.
ANALYSIS OF THE MOTION OF FREE FLIGHT MISSILES FROM BODY-FIXED SENSORS
J. K. Kryvoruka May 1970 84 p refs
(Contract AT(29-1)-789)
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Complete linear and extended nonlinear theories for angular and translational motion of free flight missiles are presented. Particular emphasis is placed on developing methods for analyzing missile motions in the form of telemetered angular rates and translational accelerations in rolling body axes. A linearized solution for complex pitching velocity is provided in body axes and the relationship to angular motion is developed. It is shown that a direct analysis of the body-fixed rate gyro and accelerometer data can be performed. The nonlinear theory includes angle of attack dependent moments and extensions to account for the effects of nonlinear translation on the rotational motion solution. Techniques are presented for the accurate analysis of both angular and translational motions for the determination of the various linear and nonlinear aerodynamic force and moment stability coefficients. In addition, the theory and analysis methods are applied to simulated reentry trajectories by a differential corrections fitting technique and the results show a high degree of accuracy. Author

N70-37753# Advisory Group for Aerospace Research and Development, Paris (France).
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7. ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS J. L. van Ingen (Tech. Hogeschool, Delft, Neth.) 34 p refs (See N70-37760 21-01)

8. ENGINE PERFORMANCE CONSIDERATINGS FOR THE LARGE SUBSONIC TRANSPORT B. Wrigley (Rolls-Royce, Ltd., Derby, Engl.) 15 p (See N70-37761 21-28)

9. THE AERODYNAMICS OF ENGINE COMPONENT DESIGN PROBLEMS ASSOCIATED WITH LARGE SUBSONIC AIRCRAFT R. Hetherington (Rolls-Royce, Ltd., Derby, Engl.) 37 p refs (See N70-37762 21-28)

N70-37755# Lockheed-Georgia Co., Marietta.
AEROMECHANICS
B. H. Little, Jr. *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 31 p refs (See N70-37753 21-01)
Avail: CFSTI

Fundamental concepts of unsteady aeromechanics and a few problems of greatest significance for large high speed subsonic aircraft are discussed. Aeromechanics is defined as the area of dynamic, low frequency interactions between aircraft and flight environment, such as flutter, buffet, and buzz. The status of unsteady aerodynamic theory is described, limited to attached flow and neglecting viscosity and heat conduction. Unsteady interference flow, subsonic and transonic flutter and buffet, transonic control surface buzz, and turbulence penetration buffet are considered. The specific aeromechanic problems discussed are auto and transonic buffet, whirl and wing flutter, aeroelastic optimization, and control surface buzz. N.E.N.

N70-37756# Lockheed-Georgia Co., Marietta.
SCALING EFFECTS ON SHOCK-INDUCED SEPARATION
B. H. Little, Jr. *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 13 p refs (See N70-37753 21-01)
Avail: CFSTI

Experiments with models in high speed subsonic flows are reviewed. It was found that good results were obtained when the following conditions are provided: a turbulent boundary layer upstream of the shock wave, shock strengths of sufficient magnitude to produce local separation, a flow adjacent to the boundary layer containing mixed subsonic and supersonic flows, and strong adverse pressure gradients downstream of the shock region. The state-of-the-art in wind tunnel testing is described, and it is felt that the significance of the interaction of separated flow regions found in experiments is confirmed by flight tests. The necessary conditions for transonic flight simulation and trailing edge criteria are mentioned. N.E.N.

N70-37757# Lockheed-Georgia Co., Marietta.
SCALING EFFECTS ON DRAG PREDICTION
J. H. Paterson *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 13 p (See N70-37753 21-01)
Avail: CFSTI

The problems in predicting the Reynolds number effect on drag during wind tunnel tests are discussed. Techniques in using wind tunnels to establish absolute drag level and to predict full scale drag levels are described, based mainly on skin friction drag increment are given. Determinations of the form factor, for finding the skin friction drag of a particular component, are outlined. Attempts at correlating profile drag with Reynolds number are evaluated, and wind tunnel drag testing techniques are discussed. N.E.N.

N70-37758# Lockheed-Georgia Co., Marietta.
HIGH REYNOLDS NUMBER SUBSONIC AERODYNAMICS
D. M. Ryle, Jr. *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 116 p (See N70-37753 21-01)
Avail: CFSTI

The phases in high speed subsonic aircraft design and development are discussed. Parametric design studies for evaluation aircraft systems and limited to trend indication and effects are outlined. Problems associated with wing shaping and contouring for high speed cruise conditions are discussed in detail, and those associated with body design are considered. The necessity for effective high lift design, approaches in design, high lift system effects, some C-5 high lift system development experience, and a design approach which may alleviate some of the problems are presented. Experience gained in developing stability and control, and flying qualities with the C-5 are described. N.E.N.

N70-37760# Technische Hogeschool, Delft (Netherlands).
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS: A PROGRAM FOR AIRFOIL SECTION DESIGN UTILIZING COMPUTER GRAPHICS
J. L. van Ingen *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 refs 34 p (See N70-37753 21-01)
Avail: CFSTI

Details are presented on the program for airfoil design and the aerodynamic analysis methods used. The complete program, including the application of computer graphics, is described, and applications of the aerodynamics subroutines are given. It is concluded that the use of computer graphics greatly facilitates the design process. N.E.N.

N70-37834*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STATIC AERODYNAMICS, FLOW FIELDS AND AERODYNAMIC HEATING OF SPACE SHUTTLE ORBITERS
E. D. Katzen, J. G. Marvin, H. L. Seegmiller, J. A. Axelson, J. J. Brownson et al *In its* Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 142-193 refs (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

Wind tunnel tests on orbiters, boosters, and launch configurations for space shuttles are discussed. The tests emphasize static stability and control at subsonic and transonic speeds, boundary layer transition at high angles of attack, and heat transfer for laminar, transitional, and turbulent boundary layers. R.B.

N70-37840*# Bell Aerospace Co., Buffalo, N.Y.
SHOCK INTERFERENCE HEATING AND THE SPACE SHUTTLE
Barry E. Edney *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 338-389 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

Schlieren photographs are presented illustrating shock interference heating for several aerospace vehicles, emphasizing the MSC orbiter and booster. The six interference types are shown, and the problems of hot spots and heat transfer are described. N.E.N.

N70-37843*# McDonnell-Douglas Co., St. Louis, Mo.
BOUNDARY LAYER TRANSITION ON LIFTING ENTRY VEHICLE CONFIGURATIONS AT HIGH ANGLE-OF-ATTACK
R. V. Masek *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 445-462 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

Methods of correlating boundary layer transition on the centerline of highly swept configurations at angles of attack between 15 deg and 60 deg were investigated. The correlating parameters included local Reynolds number at transition onset, angle of attack, local Mach number, local Reynolds number per foot, and local Reynolds number based on momentum thickness. It was found necessary to account for streamline divergence in formulating the momentum thickness for the high angle of attack data in order to

achieve reasonable correlation of the data. The resulting scatter of data around a mean curve fit corresponds to an uncertainty in transition distance of a factor of 4. The scatter of the same data using local Reynolds number at transition as the correlating parameter corresponds to an uncertainty of a factor of 20 in the transition distance. Author

N70-38116# Toronto Univ. (Ontario). Inst. for Aerospace Research.

[INSTITUTE FOR AEROSPACE RESEARCH] Annual Progress Report, 1969

Nov. 1969 175 p refs

(Grants DRB-G-9501-02; DRB-G-9511-92; DRB-G-9550-40; DRB-G-9551-16; DRB-G-9551-17 et al)

Avail: CFSTI

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1. MECHANICS OF RAREFIED GASES p 5-9 ref (See N70-38117 21-12)

2. PLASMA DYNAMICS p 10-15 (See N70-38118 21-25)

3. COMBUSTION, EXPLOSIONS AND HYPERVELOCITY p 14-25 refs (See N70-38119 21-33)

4. A COLLISIONAL TREATMENT OF THE REFLECTION OF AN IMPLODING HEMISPHERICAL SHOCK WAVE, USAF/ARL, NRC A. K. Machpherson p 25 (See N70-38120 21-23)

5. A PRELIMINARY INVESTIGATION OF SONIC BOOM PROBLEMS - NRC I. I. Glass and I. Wada p 26-27 refs

6. CALIBRATION OF CONDENSER MICROPHONE COSMIC DUST SENSOR - NRC R. L. Evans p 27-28

7. AN EXPERIMENTAL DETERMINATION OF THE POLARIZABILITY FOR SINGLY IONIZED ARGON USAF/AFOSR, NRC M. Bristow p 28-29 ref

8. AN EXPERIMENTAL INVESTIGATION OF NONEQUILIBRIUM CORNER EXPANSION FLOW OF IONIZED ARGON - NRC, USAF/AFOSR O. Igra p 29-30 refs

9. SOME ASPECTS OF NONEQUILBRIUM EXPANSION OF AN IONIZED GAS - USAF/AFOSR, NRC O. Igra p 30

10. THE DIFFRACTION OF STRONG SHOCK WAVES BY A COMPRESSION CORNER - USAF/AFOSR, NRC C. K. Law p 30-32 refs

11. A NORMAL SHOCK WAVE COMPUTER PROGRAM - USAF/AFOSR, NRC C. K. Law p 32

12. NORMAL SHOCK WAVE PROPERTIES IN CHLORINE - NRC, USAF/AFOSR Y. Kondo p 32-40

13. AERODYNAMIC NOISE p 41-48 refs (See N70-38121 21-01)

14. SUBSONIC AERODYNAMICS p 49-56 refs (See N70-38122 21-01)

15. AEROSPACE FLIGHT DYNAMICS p 58-63 refs (See N70-38123 21-01)

16. MATERIALS SCIENCE AND STRUCTURES p 64-79 refs (See N70-38124 21-32)

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18. GAS SURFACE INTERACTIONS p 87-96 (See N70-38126 21-24)

19. HIGH TEMPERATURE GAS DYNAMICS AND GAS PHYSICS p 97-105 refs (See N70-38127 21-33)

20. LASER EXCITATION AND DIAGNOSTICS p 106-112 (See N70-38128 21-16)

21. FLIGHT TRANSPORTATION p 113-115 (See N70-38129 21-05)

22. INDUSTRIAL AND ARCHITECTURAL AERODYNAMICS p 116-117 ref (See N70-38130 21-01)

N70-38121# Toronto Univ. (Ontario). Inst. for Aerospace Research.

AERODYNAMIC NOISE

In its [Inst. for Aerospace Res.] Nov. 1969 p 41-48 refs (See N70-38116 21-01)

Avail: CFSTI

The quantitative connection between jet turbulence and jet noise was studied. The noise was related to the fourth derivative of experimental hot-wire correlation curves in Chu's 1966 investigation. A re-examination has confirmed the fear that the computational technique carries a large uncertainty. Modifications to the experimental procedure are being explored in a current investigation. A complementary investigation of the properties of the turbulence in the transition region of a round jet was also studied. The results, consisting of spectra, space-time correlations, and convection speeds are reported. The sensitivity of yawed hot-wires to the tangential component of flow has been explored further. The proportionality factor k of Champagne and Webster has been found to depend somewhat on flow speed. A computer-oriented method has been developed for predicting the refracted sound field of a sinusoidal point source immersed in a jet flow. Author

N70-38122# Toronto Univ. (Ontario). Inst. for Aerospace Research.

SUBSONIC AERODYNAMICS

In its [Inst. for Aerospace Res.] Nov. 1969 p 49-56 refs (See N70-38116 21-01)

Avail: CFSTI

The Institute's activities in subsonic aerodynamics are reported with the development of air cushion vehicles (ACV) and V/STOL airplanes and their potential importance in Canada's transportation complex. The program at UTIAS during the current year included 11 separate projects, some theoretical, and some experimental. Some projects are directly related to our continuing research on the aerodynamic problems associated with the wind-generated turbulence that exists near the ground. The problems relate both to flight, especially V/STOL aircraft, and to structures such as buildings, towers, bridges, etc. It is shown that the basic assumption concerning aerodynamic forces made in earlier theoretical work on the subject is quite erroneous. The aerodynamics of an airfoil in unsteady flow, e.g., turbulence, has been studied theoretically, in an extension of Sears' classic work to oblique disturbances. Author

N70-38123# Toronto Univ. (Ontario). Inst. for Aerospace Research.

AEROSPACE FLIGHT DYNAMICS

In its [Inst. for Aerospace Res.] Nov. 1969 p 58-63 refs (See N70-38116 21-01)

Avail: CFSTI

The principal emphasis in the space flight dynamics area during the past year has been satellite attitude dynamics and control. The control systems under study included gravity-gradient, unispin, dual-spin, and trispin. Several items in the list above were initiated in the past year. An analysis of reentry flight paths has been undertaken which proposes to minimize passenger discomfort due to vehicle acceleration. In response to new Canadian satellite requirements, the involvement of this group in satellite attitude control has been maintained by the research projects in dual-tri-spin satellites. Author

N70-38130# Toronto Univ. (Ontario). Inst. for Aerospace Research.

INDUSTRIAL AND ARCHITECTURAL AERODYNAMICS

In its [Inst. for Aerospace Res.] Nov. 1969 p 116-117 ref (See N70-38116 21-01)

Avail: CFSTI

Two projects are reported which represent new research efforts in architectural aerodynamics. The efforts are intended to add to basic knowledge on the behaviour of rain and snow in the presence of natural and artificial wind fields. In addition, a number of investigations (AERCOL projects) were carried out on a variety

of structural and industrial aerodynamics problems, including an apartment building complex, a cooling tower, an office building, ventilation of a highway tunnel and others. Author

N70-38155# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE EFFECT OF HIGH INTENSITY TURBULENCE ON THE AERODYNAMICS OF A RIGID CIRCULAR CYLINDER AT SUBCRITICAL REYNOLDS NUMBER Final Report, May 1965–May 1968
David Surry Mar. 1970 211 p refs
(Contract AF 33(615)-2305)
(AD-704121; AFFDL-TR-69-98) Avail: CFSTI CSCL 1/3

The interaction of high intensity turbulence with the flow past a rigid circular cylinder was studied experimentally at subcritical Reynolds numbers. Grids were used to produce homogeneous turbulence fields with longitudinal scales ranging from 0.36D to 4.40D, and with longitudinal intensities greater than 10%. Power and cross-spectra of the turbulence components (the system input) were measured in order to carefully define the turbulence characteristics. In particular, lateral coherences of the longitudinal component were found to collapse well when plotted versus zeta/lambda (lateral separation/wavelength) as suggested by Davenport. A model with which measurement of arbitrary two-point pressure correlations could be made was used in the response experiments. Subsequent integrations yielded the spectral properties of the unsteady drag and lift. Measurement of mean drag and Strouhal frequency indicate that to some extent even severe large-scale turbulence can be considered equivalent to an increase in the effective Reynolds Number. Vortex shedding is not disrupted drastically by severe turbulence, but is affected more by that at low frequency than at high. The unsteady lift response is still dominated by the vortex shedding, whereas the unsteady drag is primarily a response to turbulence. The cross-spectra of the drag collapse well when plotted versus zeta/lambda, and were used, for one grid, to derive a describing function for the drag response to turbulence. This describing function is the central element needed for the calculation of structural response in the drag direction. Author (TAB)

N70-38173# Georgia Inst., of Tech., Atlanta. School of Aerospace Engineering.
COMPRESSIBILITY EFFECTS IN HELICOPTER ROTOR BLADE FLUTTER
Charles Eugene Hammond (Ph.D. Thesis) Dec. 1969 218 p refs Sponsored in part by Naval Weapons Lab.
(Contract DAHC04-68-C-0004; Proj. Themis)
(AD-706243; GIT-AER-69-4; AROD-T-2.13-E) Avail: CFSTI CSCL 1/3

An analytical investigation of the effect of compressibility on the flutter condition of rotary wings is presented. A two-dimensional model for the helicopter rotor flow field is postulated and used to develop a two-dimensional, unsteady, compressible aerodynamic theory. A kernel function technique is used and the resulting downwash integral equation is solved numerically by collocation using a pressure mode assumption. The resulting aerodynamic coefficients are compared with the results of two other existing theories (one incompressible and one compressible) and found to agree with these theories when the different flow models used are brought into close agreement. The compressible aerodynamic theory is used in a classical two degree of freedom flutter analysis and a variation of the flutter parameters made to establish their influence under compressible flow conditions. The results indicate that the general trend is for decreasing flutter speed with increasing Mach number. The flutter results obtained using the compressible aerodynamic theory with zero Mach number are also shown to be in excellent agreement with the results obtained using an existing incompressible aerodynamic theory. Author (TAB)

N70-38367# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THEORETICAL AND EXPERIMENTAL STUDIES OF THE SHOCK WAVE-BOUNDARY LAYER INTERACTION ON COMPRESSION SURFACES IN HYPERSONIC FLOW Final Report, Nov. 1966–Nov. 1969
Michael S. Holden Wright-Patterson AFB, Ohio AFL Jan. 1970 76 p refs
(Contract F33615-67-C-1298)
(AD-706135; CAL-AF-2410-A-1; ARL-70-0002) Avail: CFSTI CSCL 16/3

A detailed description is given of the theoretical and experimental studies of shock wave-laminar boundary layer interaction on curved compression surfaces in hypersonic flow. Integral forms of the boundary layer equations were used for the conservation of mass, streamwise momentum, normal momentum, moment of streamwise momentum and energy to describe the development of attached and separated boundary layers on a curve surface. In the experimental study, skin friction, heat transfer and pressure measurements were made on a series of flat plate-cylindrical arc-wedge compression surfaces. Pitot and cone pressure measurements were made above the surface in the separation and reattachment regions of separated flows to estimate the static pressure difference across the boundary layer. The radius of curvature of the cylindrical arc, the inclination of the wedge, and the unit Reynolds number of the free-stream were varied to examine their effect on the properties of both attached and separated interaction regions over the models. Author (TAB)

N70-38435*# Sage Action, Inc., Ithaca, N.Y.
NONLINEAR ACTUATOR DISK THEORY AND FLOW FIELD CALCULATIONS, INCLUDING NONUNIFORM LOADING
Michael D. Greenberg and Stephen R. Powers Washington NASA Sep. 1970 83 p refs
(Contract NAS1-8173)
(NASA-CR-1672) Avail: CFSTI CSCL 20D

The axisymmetric flow induced by an actuator disk with prescribed nonuniform circulation distribution is considered. Coupled, nonlinear, singular integral equations governing the wake geometry and vortex density are developed from the force-free condition and discussed from physical and mathematical points of view. An iterative solution based partly on the method of successive approximations and partly on the Newton–Raphson method is put forward, together with convergent numerical results for illustrative cases, both static and nonstatic. Corresponding detailed flow field calculations are included. Author

N70-38450*# National Aeronautics and Space Administration, Washington, D.C.
THE EFFECT OF A SPIKE ON THE DRAG AND STABILITY OF BLUNT BODIES IN SUPERSONIC FLOW
Carlos Zorea (Zaritzky) (M.S. Thesis—Israel Inst. of Tech.) Sep. 1970 73 p refs Transl. into ENGLISH of an Israel Inst. of Tech. thesis
(NASA-TT-F-13078) Avail: CFSTI CSCL 20D

The objectives of this investigation were as follows: (1) Drag reduction measurement for blunt nosed bodies as a function of spike length; (2) Determination of optimal spike lengths for supersonic Mach numbers; (3) Determination of spike's influence of the flow field; (4) Determination of spike's effect on the stability and lift of the blunt nosed body; (5) Reynolds and Mach numbers effects; and (6) Development of a semiempirical method to evaluate the optimal spike length. Experiments were carried out in the supersonic tunnel at Mach numbers of 1.5 and 2.25. The configuration chosen was a 1.5 fineness ratio nose and a hemispherical nose. The following conclusions are obtained: (1) It is possible to reduce the drag of blunt nosed configurations by means of a spike at zero angle of attack by about 15%–30%; and (2) The relation between the spike length to nose radius is the most important parameter and governs the reduction of the body's drag. Author

N70-38476*# Techtran Corp., Glen Burnie, Md.
THE IMPACT OF A SUPERSONIC FLOW OF GAS ON A FLAT OBSTACLE [UDAR NERAVNOMERNOGO SVERKHZVUKOVOGO POTOKA GAZA V PLOSKUYU PREGRADU]
M. G. Lebedev et al Washington NASA Aug. 1970 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 3, 1969 p 164-171
(Contract NASw-2037)
(NASA-TT-F-13028) Avail: CFSTI CSCL 20D

The method of Babenko and Rusanov, which is a modification of a well known method of calculating spatial supersonic flows of a nonviscous gas, modified to the case of a two-dimensional nonstationary flow, is used to solve the problem of the flow of a supersonic, uneven stream of gas around an obstacle. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-37606# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS, 1969, NO. 1: US CIVIL AVIATION
Oct. 1969 332 p
(PB-188859) Avail: CFSTI CSCL 01B

The publication contains reports of U.S. Civil aircraft accidents, in brief format. The reports are reproduced directly from the coded record on magnetic tape by electronic data processing equipment. The cause factor, accident types, operational phases, and kinds of flying, contained in the report are tabulated. Author (USGRDR)

N70-37607# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. DOUGLAS DC-3, N142D: NEW ORLEANS INTERNATIONAL AIRPORT (MOISANT FIELD), NEW ORLEANS, LOUISIANA, 20 MARCH 1969
1969 45 p
(PB-189376) Avail: CFSTI CSCL 01B

The report gives the analysis, findings, conclusions and recommendations as determined by the National Transportation Safety Board and applicable to a Douglas DC-3's crash while the crew attempted to land, the conditions being an ILS approach, RVR of less than 600 ft because of fog and smoke. USGRDR

N70-37608# National Transportation Safety Board, Washington, D.C.
A PRELIMINARY ANALYSIS OF AIRCRAFT ACCIDENT DATA, US CIVIL AVIATION, 1969
1969 30 p
(PB-189247) Avail: CFSTI CSCL 01B

The report provides a preliminary compilation and a statistical analysis of aircraft accidents in U.S. Civil Aviation that occurred during calendar year 1969. The compilation is in the form of several tables of statistical data which are attached as appendices. Author (USGRDR)

N70-37696# Bell Helicopter Co., Fort Worth, Tex.
A STABILITY AND CONTROL PREDICTION METHOD FOR HELICOPTERS AND STOPPABLE ROTOR AIRCRAFT. VOLUME 2: USER'S MANUAL Final Report, Dec. 1968-Feb. 1970
Billy J. Bird and Tyce T. McLarty Feb. 1970 164 p refs
(Contract F33615-69-C-1121)
(AD-706918; AFFDL-TR-69-123-Vol-2) Avail: CFSTI CSCL 1/3

The volume presents all documentation available to aid the user of the computer program developed in this work. The input format section provides an explanation of all of the quantities input to the computer program. Many of the inputs are defined by equations showing how they function in the program. This makes the use of the inputs as clear as possible. Four typical sets of input data are included as working examples. The output guide gives a thorough discussion of all of the forms of computer output obtained by the user. Author (TAB)

N70-37723# RAND Corp., Santa Monica, Calif.
MEASURING PRICE AND PRODUCTIVITY CHANGE IN THE AIRCRAFT INDUSTRY
J. A. Dei Rossi Apr. 1970 38 p refs
(Contract F44620-67-C-0045)
(AD-706885; RM-5805-PR) Avail: CFSTI CSCL 5/3

The study examines the problems and issues involved in estimating price and productivity change in the aircraft industry. Price indexes are derived by using pounds of airframe weight as the measure of output for aircraft and parts and pounds of thrust for the engines. These indexes are combined to provide a single aircraft industry price index. Estimates of productivity change are made using a constant elasticity of substitution production function. Constant returns to scale are assumed, and the estimate of the production function scaling factor is taken as the measure of productivity. Assuming various positive annual rates of quality change flattens out the trend line for both the price index and the productivity index. An assumed rate of about 12 percent per year would eliminate the trend in both the price index and the productivity index. Changes in output price are seemingly the result of changes in quality and productivity more than of changes in input price. Author (TAB)

N70-37730# RAND Corp., Santa Monica, Calif.
SOME DESIGN POSSIBILITIES FOR TACTICAL AIRCRAFT IN THE DECADE AHEAD
Terrell E. Greene Apr. 1970 13 p refs
(AD-707042; P-4362) Avail: CFSTI CSCL 1/3

A brief overview is given of some design options for tactical combat and support aircraft during the next decade. Although continuing advances in vehicle technology are expected, it appears that exploitation of new technology for avionics and ordnance systems can produce the most significant improvements in over-all system capability. Selected design approaches are discussed to improve aircraft control and utilization and to aid in defense penetration and weapon delivery. The potential for using existing technology to develop remotely manned systems for tactical air applications is discussed. Author (TAB)

N70-37754# Lockheed-Georgia Co., Marietta.
ADVANTAGES AND PROBLEMS OF LARGE SUBSONIC AIRCRAFT
B. H. Little, Jr. *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 13 p refs (See N70-37753 21-01)
Avail: CFSTI

The advantages of large aircraft are considered to be basically economy, which includes skin friction drag reduction, and secondarily passenger comfort and less air traffic congestion. Important problems are wing design for high subsonic speeds and good low speed performance, stability and aeroelastic effects, total configuration design and optimization, propulsion system integration requirements, and fluid flow scaling effects due to large vehicle size. The demands for large passenger and cargo aircraft is expected to be great. N.E.N.

N70-37759# Lockheed-Georgia Co., Marietta.
ADVANCED COMPUTER TECHNOLOGY IN AERODYNAMICS. LECTURE 1: COMPUTER-AIDED AIRCRAFT DESIGN
B. H. Little, Jr. *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 12 p refs (See N70-37753 21-01)
Avail: CFSTI

Applications of computer graphics in aircraft design are described. Details are given on the design program, pressure reduction, program structural analysis programs, and a numerical control program for milling operations. N.E.N.

N70-37824# RAND Corp., Santa Monica, Calif.
MARKOV CHAIN ANALYSIS OF A SITUATION WHERE CANNIBALIZATION IS THE ONLY REPAIR ACTIVITY
Alan J. Rolfe May 1970 28 p refs
(AD-707041; P-4326) Avail: CFSTI CSCL 15/5

The paper considers a group of S identical aircraft, each of which is partitioned into K parts which fail exponentially. The only way in which a failed aircraft can be repaired is by cannibalizing its out-of-commission parts from other failed aircraft. The evolution of the number of good aircraft over time is governed by the transient behavior of an absorbing Markov chain. One can therefore study this behavior by matrix multiplication although the computational problem grows large when K equals or exceeds 3. Some numerical results and some approximations are also provided. Author (TAB)

N70-37916# Bell Helicopter Co., Fort Worth, Tex.
A STABILITY AND CONTROL PREDICTION METHOD FOR HELICOPTERS AND STOPPABLE ROTOR AIRCRAFT. VOLUME 4: APPENDICES Final Report, Dec. 1968 - Feb. 1970
Billy J. Bird Mar. 1970 313 p
(Contract F33615-69-C-1121)
(AD-706919; AFFDL-TR-69-123-Vol-4)

Contents: Variable definitions; Subroutines and commons containing each common and variable; Commons and variables in each subroutine and common; Subroutines containing each variable, by common; Program sections containing each variable, by common; and FORTRAN listing. TAB

N70-37939* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANNULAR SUPERSONIC DECELERATOR OR DROGUE Patent
James F. Connors, inventor (to NASA) Issued 23 Jul. 1963 (Filed 20 Dec. 1960) 6 p Cl. 244 - 113
(NASA-Case-XLE-00222; US-Patent-3,098,630; U.S. Patent-Appl-SN-77252) Avail: US Patent Office

A supersonic decelerator is described which avoids shock-boundary layer interaction and which has no flow separation at high supersonic speeds. The decelerator provides high stability and reliability during the free fall phase by the use of a bluff-shaped annular configuration. R.B.

N70-38009* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VEHICLE PARACHUTE AND EQUIPMENT JETTISON SYSTEM Patent
Andre J. Meyer, Jr., inventor (to NASA) Issued 26 Feb. 1963 (Filed 4 Oct. 1960) 5 p Cl. 244-140
(NASA-Case-XLA-00195; US-Patent-3,079,113; US-Patent-Appl-SN-60536) Avail: US Patent Office

A parachute system for lowering a manned spacecraft from post-re-entry to an ocean landing is described. The system consists of a drogue parachute housed in a jettisonable antenna canister, and a main parachute and an auxiliary packaged in a compartment which later serves as the egress for the astronaut. The drogue chute after deployment checks both the rate of descent and incident of oscillation. The canister and drogue chute are then jettisoned and the main parachute is deployed. Emergency systems, in case the drogue chute does not deploy or is not jettisoned, or the main parachute does not deploy, are also described. N.E.N.

N70-38011* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE SWEEP AIRCRAFT WING Patent
Edward C. Polhamus, inventor (to NASA) Issued 17 Sep. 1963 (Filed 16 Nov. 1961) 8 p Cl. 244-46
(NASA-Case-XLA-00350; US-Patent-3,104,082; US-Patent-Appl-SN-153266) Avail: US Patent Office

A variable sweep wing planform for supersonic aircraft is described which is operable to vary aspect ratio without adversely affecting the control and stability characteristics of the aircraft. It is intended to maximize aspect ratio for subsonic takeoff, climb, cruise, descent, and landing, and to minimize it during supersonic cruise. In a powered aircraft having a conventional fuselage, a wing projecting from each side of the fuselage is provided. Each wing includes a main wing panel pivotally connected to the fuselage near the outboard edge, for rotation in the wing areal plane to vary the leading edge sweep, and a forward wing panel pivotally connected near its forward extremity to the fuselage and pivotally linked near its rear extremity to the main wing panel. When the main wing panel is positioned in its lowest sweep attitude, the forward wing panel is completely retracted into the fuselage. When the main wing panel is swept back toward its highest sweep attitide, however, the forward wing panel rotatably extends about its forward fuselage pivotal connection from the side of the fuselage to form a forward extension of the main wing panel. P.A.B.

N70-38140# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARACHUTE PACKING
Yu. Shtennikov 2 Feb. 1970 17 p Transl. into ENGLISH from Krylya Rodiny (USSR), v. 20, no. 2, Feb. 1969 p 26 - 29
(AD-706159; FTD-HT-23-586-69) Avail: CFSTI CSCL 1/3

The article is a sequence to study No. 11 dated 1968, which described a parachute, interaction of parts, sequence and reliability. The author now discusses, in detail, parachute packing for safety purposes. Some hints are given to skydiving instructors for conducting parachute packing classes. Author (TAB)

N70-38206# Air Weather Service, Scott AFB, Ill.
INTRODUCTION TO JET-ENGINE EXHAUST AND TRAILING VORTEX WAKES
Dale N. Jones Apr. 1970 35 p refs
(AD-707118; AWS-TR-226) Avail: CFSTI CSCL 1/3

The report is a result of a survey of the immediately available literature on aircraft wakes. While it should not be considered the final word on the subject, it is a good general representation of techniques and problems involved. The simple, approximate relations used are chosen for their simplicity and should result in an accuracy useful to define areas dangerous to fight. Author (TAB)

N70-38226# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: LOS ANGELES AIRWAYS, INCORPORATED SIKORSKY S-61L, N303Y, PARAMOUNT, CALIFORNIA, 22 MAY 1968
18 Dec. 1969 37 p refs
(PB-189143; SA-404) Avail: CFSTI CSCL 01B

About 1751 P.d.t., May 22, 1968, Los Angeles Airways Flight 841, A Sikorsky S-61L, N303Y, crashed and burned at Paramount, California. All 23 persons aboard the aircraft were fatally injured and the aircraft was destroyed by impact and fire after impact. The Safety Board determines that the probable cause of this accident was the loss of main rotor blade damper integrity due to either a failure of the black blade damper or a loss of effective damping action by the white blade damper. This resulted in uncontrolled excursions of the main rotor blades in their lead/lag axis, an overload detachment of the yellow main rotor blade pitch change control rod and destruction of the structural integrity of the aircraft by blade strikes. The precise reason for either of the possibilities for the loss of damper integrity is undetermined. Author (USGRDR)

N70-38243# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: ALLEGHENY AIRLINES, INCORPORATED, DC-9, N988VJ AND A FORTH CORPORATION, PIPER PA-28; N7374J 4 MILES NORTHWEST OF FAIRLAND, INDIANA 9 SEPTEMBER 1969

15 Jul. 1970 20 p

(NTSB-AAR-70-15; SA-417) Avail: CFSTI

An Allegheny Airlines, Inc., DC-9, N988VJ, and a Forth Corporation, Piper PA-28, N7374J, collided in flight approximately 4 miles northwest of Fairland, Indiana, at approximately 15:29 edt, September 9, 1969. All 83 occupants, 78 passengers and four crewmembers, aboard the DC-9 and the pilot of the PA-28 were fatally injured. Both aircraft were destroyed by the collision and ground impact. Allegheny 853 was under positive radar control of the Federal Aviation Administration's Indianapolis Approach Control, descending from 6,000 feet to an assigned altitude of 2,500 feet at the time of the collision. N7374J was being flown by a student pilot on a solo cross-country in accordance with a Visual Flight Rules flight plan. The collision occurred at an altitude of approximately 3,550 feet. The visibility in the area was at least 15 miles, but there was an intervening cloud condition which precluded the crew of either aircraft from sighting the other until a few seconds prior to collision. Based in part upon this investigation, the Board has submitted recommendations to the FAA concerning establishment of minimum standards for radar reflectivity of small aircraft, and mandatory aircrew training programs on effective scanning patterns and procedures. Author

N70-38357# Bell Helicopter Co., Fort Worth, Tex.

A STABILITY AND CONTROL PREDICTION METHOD FOR HELICOPTERS AND STOPPABLE ROTOR AIRCRAFT. VOLUME 3: PROGRAMMER'S MANUAL Final Report, Dec. 1968 - Feb. 1970

Billy J. Bird Wright-Patterson AFB, Ohio AFFDL Mar. 1970 37 p

(Contract F33615-69-C-1121)

(AD-706374; AFFDL-TR-69-123-Vol-3) Avail: CFSTI CSCL 1/3

The report describes a mathematical model of rotorcraft that may be used to determine characteristics of performance, stability, response, and rotor blade loads. The complexity of the equations used requires the use of a digital computer for efficient solution. This volume contains aids for the computer programmer. The programming aids are divided into two groups: Background material for the programmer just starting to work on this computer program and the detailed explanation of the computer generated documentation which is necessary for any programmer to work effectively on this program. Author (TAB)

N70-38390# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.

ENGINEERING APPROXIMATION OF MAXIMUM ACCELERATIONS EXPERIENCED BY PLANNING CRAFT IN ROUGH WATER Final Report

John K. Roper Dec. 1969 35 p refs

(Contract N00014-67-A-0202-0014)

(AD-706098; SIT-DL-69-1437) Avail: CFSTI CSCL 1/3

An engineering procedure is presented for estimating the maximum impact accelerations experienced by planing craft in irregular head seas. General agreement between calculated and model test results indicates that the proposed method is realistic. The procedure should be particularly useful during preliminary design. Author (TAB)

N70-38434# Vitro Labs., Silver Spring, Md.

STRATOSCOPE 2 INFLATION ANALYSIS

G. C. Maloney and D. L. Mann 1 Mar. 1970 111 p ref

(TN-02205.02-1) Avail: CFSTI

The large lift forces associated with the inflation of the launch balloon in heavy-load tandem balloon systems require careful analysis in order to design equipment and procedures which will not overstress the balloon material. This analysis is especially critical if the inflation is conducted in the presence of high or gusty winds, as is the case in Project Stratoscope 2 where peak gusts up to 15 mph are considered tolerable. Present inflation techniques all involve the use of a collar placed around the launch balloon which is moved down as inflation proceeds. Above the collar an inflated bubble is maintained, and below the collar the uninflated portion of the balloon is sleeved. The analysis of inflation forces anticipated on Project Stratoscope 2 in connection with a new, improved inflation technique which eliminates the requirement for donut suspension lines and which at no time will stress the balloon material to its critical failure point, is described. The inflation technique was successfully demonstrated between February 1968 and April 1970 in three stratoscope 2 inflations. Author

N70-38625*# National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif.

FLIGHT INVESTIGATION OF THE ROLL REQUIREMENTS FOR TRANSPORT AIRPLANES IN CRUISING FLIGHT

Euclid C. Holleman Washington Sep. 1970 107 p refs

(NASA-TN-D-5957; H-616) Avail: CFSTI CSCL 01C

An airborne simulator provided a wide range of maximum roll control power and time constants for pilot evaluation and rating. Roll criteria were developed and compared favorably with previously reported criteria. Maximum roll angular acceleration, maximum roll rate, roll time constant, time to bank, and bank-angle change in a given time all appear to be effective roll-criteria parameters. Steady-state roll rates of about 20 deg/sec and roll time constants of 1.8 seconds or less were required for satisfactory pilot ratings. With experienced test pilots, valid evaluation of single-degree-of-freedom roll response can be obtained with a fixed-base simulator. Author

N70-38644# National Transportation Safety Board, Washington, D.C.

MOHAWK AIRLINES, INC., FAIRCHILD HILLER FH-227B, N7811M, NEAR GLEN FALLS, NEW YORK, NOVEMBER 19, 1969

25 Jun. 1970 29 p refs

(NTSB-AAR-70-12) Avail: CFSTI

The flight had been cleared for a VOR approach with a ceiling of 2100 feet overcast, and visibility of 7 miles in light rain. The flight overflew Glen Falls at 3000 feet and proceeded north for about 1 minute and 15 seconds at which time a left turn was initiated preparatory to return to the airport to land on runway 19. During the last portion of this turn, the aircraft contacted trees on the northwest slope of Pilot Knob Mountain on a heading of about 180 deg, approximately 1 nautical mile east of Kattskill Bay, New York. It then impacted the face of a rock cliff, after which it dropped approximately 38 feet, became lodged between trees and the side of the mountain, and burned. It was determined that the

probable cause of the accident was that the pilot, while conducting an approach, exceeded the clearance limits and flew the aircraft into a severe lee of the mountain downdraft at an altitude insufficient for recovery. No evidence was found to explain why this particular approach was attempted. Author

N70-38666# Civil Aeronautics Board, Washington, D.C.
CIVIL AERONAUTICS BOARD Annual Report, Fiscal Year 1969
1969 131 p refs
Avail: SOD $1.25

The activities of the Civil Aeronautics Board are reported. Major problems are considered airport and airways congestion, and surface traffic between airports and city centers. Hearings were completed on the Northeast Corridor VTOL feasibility investigation. Other topics discussed include: domestic air commerce, international aviation, rate regulation, planning, programming and research activities. F.O.S.

N70-38782# Advisory Group for Aerospace Research and Development, Paris (France). Propulsion and Energetics Panel.
AIRCRAFT ENGINE NOISE AND SONIC BOOM Technical Evaluation Report on Agard Specialists' Meeting
John O. Powers (FAA, Washington, D.C.) and M. Pianko (Serv. Tech. Aeron., Paris) Jun. 1970 8 p refs
(AGARD-AR-26-70) Avail: CFSTI

A brief evaluation of aircraft noise generation and reduction techniques is given. Jet, fan, and compressor noise sources, noise prediction, designs for noise source control and reduction, acoustic path control, and acoustic impact on receivers are included. J.M.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-37638# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MHD METHODS OF OBTAINING ELECTRICAL ENERGY: ANNOTATION AND PREFACE
V. A. Kirillin et al 2 Apr. 1970 11 p Transl. into ENGLISH from the Russian
(AD-706160; FTD-MT-24-294-69) Avail: CFSTI CSCL 10/2

The document is comprised of an annotation and preface to a book which is a collection of articles whih present results of scientific research on MHD generators in 1966-1967 at leading USSR organizations. The collection contains a description of research results on the first USSR experimental power installation with the U-02 MHD generator; technical economic analysis of future promising power plants with MHD generators; results of research in physics of plasmas and MHD as applied to problems of MHD generators; and results of work on liquid-metal MHD installations. Author (TAB)

N70-37652# Sundstrand Aviation-Rockford, Ill.
ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM Quarterly Progress Report, 1 Jul. 1969 - 1 Jan. 1970
R. E. Niggemann 15 Mar. 1970 43 p ref
(Contract AT(04-3)-651)
(SAN-651-1186; QPR-14) Avail: CFSTI

The technology necessary to develop an organic Rankine cycle power conversion system capable of long duration operation in a space environment is investigated. The various studies include the working fluid, the bearings, the condensate pump, and the boilers. The performance of the Sunstrand 6 kwe organic Rankine cycle power system was also evaluated. R.B.

N70-37655# Globe-Union, Inc., Milwaukee, Wis.
ORGANIC ELECTROLYTE BATTERY Final Report
Guy D. Mc Donald Nov. 1969 71 p refs Sponsored by AEC
Prepared for Sandia Corp., Albuquerque, N.Mex.
(SC-CR-69-3290) Avail: CFSTI

The variables affecting the fabrication of electrodes for organic electrolyte batteries were studied using silver chloride electrodes produced by pelletization, sintering, press binding, and paste binding. A statistically designed experiment on pelletized electrodes showed that the pressure used in electrode preparation, the type of grid material, and the electrolyte used for testing are the most important variables. Preliminary work with other fabrication techniques determined the ranges for each electrode fabrication variable which will result in structurally sound electrodes. The applicability of the galvanostatic transient technique and the transfer function technique for surface area determination to organic electrolyte systems was demonstrated. Silver chloride electrodes were prepared which were capable of delivering up to one hundred milliamps per square centimeter when discharged in an organic electrolyte. The major source of polarization was shown to be caused by diffusion limitations. Author (NSA)

N70-37679# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS
Frederick W. Sarles, Jr., Wayne C. Haase, and Paul F. Mc Kenzie 23 Jan. 1970 24 p refs
(Contract AF-19(628)-5167)
(AD-707134; ESD-TR-70-3; TR-476) Avail: CFSTI CSCL 10/2

Instrumentation was developed which automatically measures the V-1 characteristics of a number of solar cells, and transmits the resultant serialized data stream over an RF telemetry link. The particular system was designed for 64 cells whose selection is accomplished entirely by semiconductor switching. Two-hundred-and-fifty-two points are taken on the V-1 characteristic, giving detailed information on slopes as well as actual values. Measurement accuracies are 0.03 percent of full scale for voltage, and 0.1 percent for current; these do not represent attainable limits, but are simply reasonable limits for this specific application. The system described was built to calibrate solar cells on a high-altitude balloon flight, but the techniques can be used equally well for ground or satellite applications. Author (TAB)

N70-37715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROBLEM OF CONSTRUCTING SUPERCONDUCTING MAGNETIC SYSTEMS FOR MHD-GENERATORS
V. V. Sychev et al 22 Apr. 1970 31 p refs Transl. into ENGLISH from the Russian
(AD-706779; FTD-HT-24-356-69) Avail: CFSTI CSCL 10/2

The direction towards which research and development in superconducting systems is going is reviewed. Nb-Ti alloys are found to dominate development of superconducting cables. The nature of field penetration in nonideal superconductors is shown to present a vexing problem. The actual design and construction of large scale superconducting systems is shown to be in its infancy. The concept of a magnetic pump for generating high currents in superconductors is emphasized. A detailed account is then given of the research going on in the High Temperature Institute. These include special flux linkage solenoid windings and an investigation in the induction of these superconducting solenoids. The detailed characteristics of three 65BY alloy superconducting solenoids are

listed with solenoid constants of 0.78, 2.25, and 0.71 kilo-oersteds/amp. A figure compares the experimental and theoretical flux linkage curves of the three solenoids as a function of the nondimensional excitation current. Careful measurements are made of the static and dynamic inductance of each solenoid. The results show the connection between the inductance and the current during the first excitation, without prior history; the relationship between the inductance and the current during the solenoid discharge. Author (TAB)

N70-37913 IIT Research Inst., Chicago, Ill.
ASYMMETRY CHARACTERISTICS OF PROGRESSIVE SHORT-CIRCUITS ON LARGE SYNCHRONOUS MACHINES
Robert Ellis Owen (Ph.D. Thesis) 1969 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-18616

An investigation was conducted to determine if current asymmetry, produced by progressive short-circuits (non-simultaneous two-phase-to-neutral or three-phase), would produce difficulties for two-cycle (interrupting time) circuit breakers installed at generating stations. The investigation indicated that progressive faults can produce severe current offset, and that modern generators of large rating tend to sustain the offset more than older units. The process of multiphase interruption, by first clearing those phases possessing early current zeroes, reduces the offset in the remaining faulted phases so that interruption may proceed in later clearing phases at a much earlier time—eleven cycles were reduced to three cycles for the worst case. Fault resistance, breaker arc resistance, and system load, not treated in the analysis, are expected to induce shorter times to reach current zero than those computed. Dissert. Abstr.

N70-37987*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: SYCHRONOUS ORBIT TESTING OF GENERAL ELECTRIC COMPANY 6.0 AMPERE-HOUR NICKEL-CADMIUM CELLS
D. E. Christy and D. G. Miley 14 Aug. 1970 41 p
(NASA Order W-12397)
(NASA-CR-113115; QE/C-70-634) Avail: CFSTI CSCL 10B

Principal results indicate that: (1) A temperature of 40 C is very detrimental to cells in a synchronous orbit regime. (2) A temperature of -20 C results in high cell voltages during charge, and an extremely low trickle charge must be maintained to keep the voltage at or near 1.50 volts. In general, as the environmental temperature goes down, the charge voltage goes up. Also at low temperature, the charge voltage fluctuates more radically with slight variations of test conditions. (3) Coulometers are effective charge control devices when operative. However, they have shorter lives than the cells they control. (4) The voltage balance, during discharge, between the high and low cells of a synchronous pack is best at 25 C and worst at 40 C. Also, age and greater depths of discharge result in greater degradation of pack voltage balance. (5) The capacity checks performed during the middle of each eclipse season initiated the following: A slight increase in average discharge voltage generally occurs within one or two days following the capacity check except for operation at 40 C. The reverse is noted for 40 C. For non-coulometer controlled cells, the average positive slope (discharge voltage) following the check slightly exceeds the negative slope preceding the check. Author

N70-38040*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TESTS OF GULTON INDUSTRIES 6.0 AMPERE-HOUR NICKEL-CADMIUM CELLS WITH GULTON PLATES
D. E. Christy and D. G. Miley 14 Aug. 1970 18 p
(NASA Order W-12397)
(NASA-CR-113115; QE/C-70-662) Avail: CFSTI CSCL 10B

The results of acceptance tests completed on 30 cells are reported. The tests were performed at an ambient temperature between 23 and 27 C at existing relative humidity and atmospheric pressure. The tests included: physical inspection, capacity test, cell short test, leak test, overcharge test, and internal resistance measurement. Author

N70-38091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING THE MAIN DIMENSIONS OF A SYNCHRONOUS GENERATOR FOR OPERATING INTO AN IMPULSE LOAD
A. I. Bertinov et al 30 Jan. 1970 17 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 12, 1968 p 29-34
(AD-706173; FTD-HT-23-604-69) Avail: CFSTI CSCL 10/2

An analysis is made of low frequency pulsed systems, in which the capacitor charge time greatly exceeds the action time of the free supertransient and transient currents, the effect of the electrical inductor circuits (excitation and damper windings) on the charge process is insignificant and the curve of the voltage increment in the capacitor can be approximated by an exponential curve whose time constant is proportional to the synchronous resistances of the generator. The main dimensions of the synchronous generator in a low frequency pulse system can be determined by proceeding from the necessary values of the synchronous inductive resistances of the armature winding. TAB

N70-38190*# Philco-Ford Corp., Palo Alto, Calif. Western Development Lab. Div.
FLIGHT DATA ANALYSIS OF POWER SUBSYSTEM DEGRADATION AT NEAR SYNCHRONOUS ALTITUDE Final Report
W. T. Picciano and R. A. Reitman 15 Jul. 1970 363 p refs
(Contract NASw-1876)
(NASA-CR-112952; WDL-TR4223) Avail: CFSTI CSCL 10B

A large accumulation of high quality telemetry data on 19 of 26 identical satellites orbiting at near-synchronous altitudes was processed and an attempt was made to extract a maximum amount of information on the degradation and behavior of the solar arrays. The results and calculational methods were compared with other available methods to derive generalizations to benefit future programs. Recommendations are made to prevent degradation of the solar cells due to damage from trapped particles and solar flare protons. R.B.

N70-38210# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLAR PANEL TEST SET
William E. Ray Feb. 1970 29 p
(Contract NOw-62-0604-C)
(AD-707345; APL-TG-1103) Avail: CFSTI CSCL 14/2

The report describes the Solar Panel Test Set developed for testing solar cell panels in artificial sunlight at an equivalent sunlight intensity of 140 mW/sq.cm. The test set uses iodine-quartz (tungsten) lamps as the radiant-energy source, and the emerging radiation is uniformly reflected and totally diffused. An air conditioner, which is part of the test set, provides the cooling air necessary to control the temperature of the solar panel under test. The methods of calibrating the test set are described, and the accuracy of the measurements obtained when using artificial light as the radiation source is discussed. Author (TAB)

N70-38462# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF FLUID CONTAMINATION OF THE

OPERATING RELIABILITY OF AIRCRAFT HYDRAULIC SYSTEMS

G. A. Nikitin et al 10 Apr. 1970 235 p refs Transl. into ENGLISH from the Russian

(AD-707303; FTD-MT-24-463-69) Avail: CFSTI CSCL 13/7

The report contains investigation results and generalized literature data regarding the effects of contamination of working fluids on operating reliability of units of hydraulic aircraft systems. Methods are analyzed for determination of contamination. Data are given on contamination of fluids supplied by the industry and contamination of fluids of operating hydraulic systems. An analysis is given of dynamics of contamination changes in relation to the operating period of systems, designs of test stands, and instrumentation used for investigations. Recommendations are given on reduction of the harmful effect of contamination on reliability and useful life of hydraulic units. Author (TAB)

N70-38489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OBSERVATIONS ON THE CUPROUS SULFIDE LAYER ON SINGLE CRYSTAL CADMIUM SULFIDE

Joseph Singer Washington Sep. 1970 13 p refs

(NASA-TM-X-2073; E-5727) Avail: CFSTI CSCL 20L

The topography of the copper phase formed on single crystal cadmium sulfide was investigated by electron microscopy for reactions between CdS and both Cu(0) and Cu(+). With metal films, the reaction produced well-defined separated pits which were attributed to cuprous sulfide crystallites that had been removed prior to replication of the surface. Considerable variation in the topography of the reaction was found; this was attributed to differences in surface defect concentration in the CdS. The Cu2S formed preferentially along prism plane traces. The reaction with Cu(+) was much more rapid and extensive. Author

N70-38614*# General Electric Co., Philadelphia, Pa. Missles and Space Div.

TESTING OF SILVER CADMIUM CELLS Final Report

M. D. Read 1 May 1970 47 p

(Contract NAS3-13223)

(NASA-CR-72719; GE-SSO-70SD249) Avail: CFSTI CSCL 10C

A test program was carried out to determine the life cycling capability of silver cadmium cells constructed with a new type of inorganic separator. Cells were cycled in packs of 5 at ambient temperatures of 100 C (373 K) and 25 C (298 K) on stand and on 24 hour, 8 hour, and 1 and 1/2 hour cycle test at various depths of discharge. Testing was continued until all cells failed and each cell was disassembled for failure analysis. The analyses revealed that the most probable cause of failure for these cells was silver migration and separator permeability. Author

N70-38713* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SWITCHING MECHANISM WITH ENERGY STORAGE MEANS Patent

William A. Leavy, inventor (to NASA) Issued 21 Jul. 1964 (Filed 18 Sep. 1961) 5 p Cl. 200-39

(NASA-Case-XGS-00473; US-Patent-3,141,932; US-Patent-Appl-SN-139012) Avail: US Patent Office CSCL 13I

A driven switch actuation mechanism, with a mechanical reset feature capable of completing its operation cycle after the input drive is deactivated, is described. A rotatable coil spring stores energy as a result of the rotation of the driven device, such as a tape recorder, and is triggered by the device when it reaches a desired position. The stored energy is sufficient to allow the cutoff switch to be actuated and to return the switch to its normal operating position. N.E.N.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-37609# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.

SCHEMATIC CONCEPT FORMATION AS A FUNCTION OF STIMULUS DISPLAY AND MODE OF RESPONSE

Margaret A. Hastings and Selby H. Evans Feb. 1970 36 p refs

(Contract DAAD05-68-C-0176)

(AD-707368; HEL-TM-3-70) Avail: CFSTI CSCL 5/10

The purpose of the experiment was to determine the influence of both response mode and stimulus representation upon schematic concept formation. To realize this objective, response mode, stimulus display and stimulus presentation order were manipulated in a three-factor design. Author (TAB)

N70-37625# Sandia Corp., Albuquerque, N.Mex.

ELECTROSTATIC DEPOSITION DEVICE TO DEPOSIT MONOLAYERS OF BACTERIAL SPORES ON TEST SURFACES

Willis J. Whitfield [1970] 19 p Presented at 19th Ann. Tech. Meeting and Exhibit of the Am. Assoc. of Contamination Control, Anaheim, Calif. Sponsored by AEC

(SC-DC-70-4833; CONF-70049-1) Avail: CFSTI

A device was developed to deposit bacteria in monolayers on test surfaces. It was developed in an effort to eliminate clumps of bacteria which appear to provide some form of protection for bacteria during dry heat sterilization cycles. Experimental results using this device showed that clumped bacteria requires longer heating periods than do bacteria deposited as monolayers. This device, known as the electrostatic deposition device, aerosolizes suspensions of bacteria which are charged with a negative charge. The charged bacterial particles are attracted to positively charged test strips located on a rotating turntable. A potential of 30 to 40 kilovolts is used by the device to charge and deposit bacteria on the test strips. Standard stainless or aluminum test strips are used. Author

N70-37867# Cornell Univ., Ithaca, N.Y.

STUDIES OF PHOTOSYNTHETIC ENERGY CONVERSION Annual Progress Report, 1 Sep. 1969 - 31 Aug. 1970

Roderick K. Clayton 31 Aug. 1970 7 p refs

(Contract AT(30-1)-3759)

(NYO-3759-17) Avail: CFSTI

Continuing studies and future plans in the biochemical research are briefly reported. The topics include the following: synthesis of electron transport systems associated with photosynthetic reaction centers; photochemical mechanism in reaction centers; photosystems in Rhodopseudomonas spheroides; membrane potentials; virology; reaction center purification; primary and secondary electron acceptors and donors in reaction centers; electron transport kinetics in reaction centers; and bacteriochlorophyll fluorescence yield in vivo. N.E.N.

N70-37923# Naval Medical Research Inst., Bethesda, Md.

THE EFFECT OF HYPERBARIC EXPOSURE ON SERUM CONSTITUENTS IN THE RAT: A PRELIMINARY STUDY

George M. Adams, Richard E. Danziger, Edgar M. Neptune, Jr., Terry L. Sallee, and David E. Uddin 14 May 1970 11 p refs

(AD-706740; NAVMED-M4306-02-4010B-1) Avail: CFSTI CSCL 6/19

Rats were exposed to 90 PSIG on an 80:20 helium-oxygen gas mixture and decompressed on two different schedules, designed to produce moderate and severe bends. Serum samples were obtained immediately after the dive and analyzed for lipid distribution, serum lactic dehydrogenase, lipoproteins, haptoglobin, glucose, and lactate. The results of these determinations are discussed in relation to decompression sickness. Author (TAB)

N70-37930# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
THORACIC IMPACT: THE STATIC AND DYNAMIC BEHAVIOR OF THE HUMAN THORACIC SKELETON
S. B. Roberts *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 283-302 (See N70-37926 21-34)
Avail: Issuing Activity

The effort during the past year has been focused upon obtaining a predictive capability for the elastostatic behavior of the thoracic skeleton. A comprehensive static analysis capability is deemed to be an important preliminary step toward the construction of a dynamic analysis. Specifically this entails the development of the necessary analytic tools (in the form of a finite element computer program), the material, and geometric properties of the system as well as meaningful loading conditions. Some rib stiffness data has been experimentally obtained, and a preliminary Thorax I structural model has been constructed and computer analyses have been conducted. Author

N70-37931# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
CARDIOVASCULAR IMPACT: AORTA RUPTURE
R. Collins *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 303-342 refs (See N70-37926 21-34)
Avail: Issuing Activity

Origin and magnitude of forces necessary to rupture the aorta in automobile accidents were studied by the following supporting analyses: (1) stress measurements in the viscera between the thorax and the cardiovascular region; (2) impulse flow dynamics in glass models of curved vessels; (3) *'in vitro'* tensile dynamics of human aorta at different loading or strain rates; and (4) *'in situ'* tensile tests of aorta wall tissue under dynamic loading to obtain information for empirical estimates of rupture strength of aorta walls. A numerical method of characteristics was used to evaluate equations of motions for the fluid and stress-strain relationships in aorta rupture mechanics. G.G.

N70-37932# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
MECHANICAL CHARACTERIZATION OF HUMAN TISSUE
R. A. Westmann *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 343-371 refs (See N70-37926 21-34)
Avail: Issuing Activity

Primary effort has been directed toward the basic fracture properties of human bone. Analytical, experimental and histological studies of bone material have been performed and the results of these may be summarized as follows: (1) based on the data available, it appears that modern fracture mechanics provides an appropriate theory for examining the fracture properties of human bone; (2) a typical value for the fracture toughness or critical crack tip stress intensity factor for human humerus bone is about 3,100 psi per sq root inch; and (3) there appears to be little difference between the fracture properties of embalmed and fresh (seven day) human humeri. Author

N70-37933# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
HEAD INJURY
S. B. Roberts *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 373-417 refs (See N70-37926 21-34)
Avail: Issuing Activity

The series of analytic studies reported was designed primarily to: (1) determine the feasibility of mathematically modeling the blunt trauma head problem; (2) to determine response sensitivity to selected variations in stiffnesses and applied forces; and (3) to establish guidelines for future experimental efforts. The results indicate that it is possible to employ relatively simple dynamic mathematical models of the human, and predict gross response of the major anatomical elements. Conclusions on response in the head-neck region are: (1) the motion of the forearms and upper arms does not significantly influence the kinematics or deformation in the head-neck region; (2) the head-neck response is quite sensitive to the location of the applied forcing function; (3) there is a clear response dependence upon the neck translational and rotational stiffness; and (4) the shape of the applied force-time history, in particular the initial slope or rise time, affects response. Author

N70-37934# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
NEUROLOGIC STUDIES
A. M. Nahum *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 419-421 (See N70-37926 21-34)
Avail: Issuing Activity

Reported are a series of impact tests on primates implanted stereotaxially with neurophysiological recording devices and trained for baseline behavioral tasks. Accurate reproductible data of the impact event were obtained and baseline blood values were established. G.G.

N70-37984# Vermont Univ., Burlington. Dept. of Psychology.
EKG CHANGES FROM PRE- TO POST-TIME ESTIMATION PERIOD ACROSS MULTIPLE SENSORY DEPRIVATION TRIALS Interim Report
Gary Mc Clure and Donald G. Forgays Mar. 1970 12 p refs
(Contract F44620-69-C-0001; Proj. THEMIS)
(AD-706380; AFOSR-70-1412TR; TR-5) Avail: CFSTI CSCL 6/16

The report summarizes data taken from four subjects exposed to multiple sensory deprivation runs. The water-immersion technique of isolation was employed and the subject run for three trials, spending an average of nearly seven hours per trial. Continuous EKG data obtained on each run was partitioned into 5% portions of total run and a constant part of these portions was compared. While earlier analyses had indicated a pattern of decreasing EKG across trials, the present more sensitive analysis shows the importance of an individual difference analysis. Author (TAB)

N70-37985# Vermont Univ., Burlington. Dept. of Psychology.
AROUSAL AND REPEATED ISOLATION EXPERIENCES Interim Report
Gary Mc Clure and Donald G. Forgays Mar. 1970 11 p refs
(Contract F44620-69-C-0001; Proj. THEMIS)
(AD-706379; AFOSR-70-1411TR; TR-4) Avail: CFSTI CSCL 5/10

The report presents the results of four male adult subjects exposed to sensory isolation through water-immersion for three trials totaling about 20 hours. The results presented are EKG frequencies taken before and after time-estimation hacks throughout the runs. EKG frequency taken before time hacks showed a decrease across trials; that taken after time hacks displayed a rather steady picture. These results were viewed as evidence for the notion that stress arousal may be ameliorated with experience while arousability may remain at the same level. Author (TAB)

N70-38049# Pennsylvania Univ., Philadelphia.
NON-THERMAL EFFECTS OF ALTERNATING ELECTRICAL FIELDS ON BIOLOGICAL STRUCTURES Final Report, 1 Mar. 1964 - 31 Dec. 1969

Herman P. Schwan 30 Apr. 1970 10 p
(Contract Nonr-551(52))
(AD-706772) Avail: CFSTI CSCL 6/3

A summary is given of a research program involving the following phases: The feasibility of rapidly freezing and thawing blood; The dielectric properties of hemoglobin bound water; Electrical properties of erythrocytes; Field induced force effects and their biological significance; Survey of biohazards and related biophysics. A list of the 59 publications resulting from the work is included. TAB

N70-38083# Princeton Univ., N.J. Psychology Lab.
ELECTRONIC COMPUTER PROGRAMS: GENERAL DESCRIPTION
Harold Gulliksen May 1970 5 p Prepared in cooperation with Educational Testing Service
(Contract N00014-67-A-0151-0006; Grants NSF GJ-34; NSF GU-3157)
(AD-707437) Avail: CFSTI CSCL 5/10

Five programs for scaling and two for parameter estimation and learning curves that have been developed in connection with a project on mathematical techniques in psychology are described briefly. TAB

N70-38088# Massachusetts General Hospital, Boston. Stanley Cobb Labs. for Psychiatric Research.
THE EFFECTS OF SENSORY DEPRIVATION AND VARIED SENSORY INPUT ON ELECTROPHYSIOLOGIC AND METABOLIC ACTIVITIES ON THE CENTRAL NERVOUS SYSTEM Final Technical Report, 19 Feb. 1959 - 29 Feb. 1968
Frank R. Ervin and Jack H. Mendelson 30 Jun. 1969 198 p
(Contract Nonr-1866(41))
(AD-707174) Avail: CFSTI CSCL 6/19

A final report is made for nine years of work done under contract. Advances in the study of sensory deprivation are considered and the direction of experiments within the larger field are outlined. Current work in progress is discussed in three detailed reports. The first examines the neuroanatomy of visual centers within the brain linked to a non-functioning eye. In the second report a method of characterizing the maturity of a layered neural structure was derived from cell population counts in normal rat superior colliculus. The third report updates earlier descriptions of an approach to biological unit counting through computerized scanning procedures. Author (TAB)

N70-38189*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
THE REVERSIBLE INHIBITION OF SPORE GERMINATION BY ALCOHOLS
Ralph Trujillo and Nancy Laible Aug. 1970 13 p refs Submitted for publication
(NASA Order W-12853)
(NASA-CR-112984; SC-DC-70-4937) Avail: CFSTI CSCL 06M

Low levels of alcohols were found to inhibit the process of spore germination. The extent of germination is dependent upon the concentration of alcohol present in the germinating medium. This inhibition is reversible since removal of the alcohol from the spore environment allows germination to proceed. Author

N70-38220# Naval Submarine Medical Center, Groton, Conn.
TENTATIVE AUDIOMETRIC HEARING THRESHOLD LEVEL STANDARDS FROM 8 THROUGH 18 KILOHERTZ Interim Report
J. Donald Harris and Cecil K. Myers 11 Feb. 1970 8 p refs
(AD-706324; SMRL-MR-70-2; Rept-9) Avail: CFSTI CSCL 6/16

Both ears of 100 young healthy candidates for Submarine Service, aged 17-23 years, normal by otoscopy but otherwise unselected, were given Bekesy-type audiometry through 18 kiloHertz. Minimum audible pressures in the ear canal were obtained comparable to those from a published study on adolescent males; there is also correspondence with the British 1954 Standard for young adults up to 15 kiloHertz. It is suggested that the time is approaching for International Standardizing of audiometry in the octave 10-20 kiloHertz using all available data. Author (TAB)

N70-38238# St. Louis Univ., Mo. Dept. of Biology.
DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF AUTOMATIC EQUIPMENT TO SUBJECT SUSPENSION CELL CULTURES TO REPETITIVE HYPOXIC SHOCK
David W. Rooney 1 May 1970 9 p refs
(Contract N00014-69-A-0206-0001)
(AD-707090; TR-1) Avail: CFSTI CSCL 6/3

Described are 6 criteria which must be met in the design of equipment for applying intermittent hypoxia to suspension cell cultures. Also described is a programmed manifold system which was designed and built to meet the 6 criteria. Author (TAB)

N70-38291*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
MICROBIAL STERILIZATION IN ULTRA-HIGH VACUUM AND OUTER SPACE: A KINETIC COMPARISON
J. P. Brannen Aug. 1970 5 p refs Submitted for publication
NASA Order W-12853)
(NASA-CR-112963) Avail: CFSTI CSCL 06M

The absolute reaction rate theory is used to establish a correlation between microbial die off in ultrahigh vacuum and outer space. Thermodynamic formulation is described for the case of microorganisms being sterilized by a first order chemical reaction. The results indicate that, from a kinetic viewpoint, D values obtained under ultrahigh vacuum (10 to the minus 6th power torr) are not appreciably different from those obtained under the pressure of outer space (10 to the minus 17th power torr). D.L.G.

N70-38292*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
AN ANALYSIS OF VACUUM EFFECTS IN THE STERILIZATION OF MICROORGANISMS
J. P. Brannen Aug. 1970 11 p refs Submitted for publication
(NASA Order W-12853)
(NASA-CR-112962) Avail: CFSTI CSCL 06M

By using the thermodynamic formulation of the absolute reaction-rate theory, variations in pressure can be incorporated in a rational model for dry-heat sterilization of microorganisms. Coupling this model to observations, a value for the volume change, as the reactant goes into the activated state, of 15 to 65 liters/mole is estimated for the sterilizing reaction. The theoretical volume change for DNA is about 7 liters/mole. Author

N70-38293*# Informatics Tisco, Inc., College Park, Md.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Washington NASA Jul. 1970 106 p refs Sponsored by NASA
(NASA-SP-7011(78)) Avail: CFSTI CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N70-38319*# Translation Consultants, Ltd., Arlington, Va.
BIOCHEMICAL EVOLUTION OF ENZYME SYSTEMS AS A BASIS OF THE FUNCTIONAL EVOLUTION OF VERTEBRATES [BIOKHIMICHESKAYA EVOLYUTSIYA FERMENTNYKH SISTEM KAK OSNOVA FUNKTSIONALNOY EVOLYUTSII POZVONOCHNYKH ZHIVOTNYKH]
N. A. Verzhbinskaya Washington NASA Sep. 1970 20 p refs Transl. into ENGLISH from the publ. 'Aiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 169–180
(Contract NASw-2038)
(NASA-TT-F-13194) Avail: CFSTI CSCL 06C

The biochemical development of the acetylcholine system as the basis for the development of the synaptic, mediatory function in various classes of vertebrates is traced. The role of acetylcholinesterase is discussed. Author

N70-38350# Princeton Univ., N.J.
THE COUNTBACK METHOD FOR ANALYZING SENSITIVITY DATA
Charles Lewis (Ph.D. Thesis) May 1970 101 p refs Prepared in cooperation with Educational Testing Service
(Contract N00014-67-A-0151-0006; Grant NSF GB-3402)
(AD-707355; RB-70-30) Avail: CFSTI CSCL 5/10

Sensitivity data are defined as involving two response categories, with responses observed at different levels of some variable of interest. The responses are taken to indicate sensitivity to the variable, and, in this regard, may be labeled positive and negative. Of particular interest in analyzing sensitivity data is the estimation of the 50% point, the level of the variable for which the two responses are equally likely. Author (TAB)

N70-38373*# Translation Consultants, Ltd., Arlington, Va.
CHEMICAL ECOLOGY [GEOKHIMICHESKAYA EKOLOGIYA]
V. V. Kovalskiy Washington NASA Sep. 1970 16 p refs Transl. into ENGLISH from the publ. 'Aiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 188–197
(Contract NASw-2038)
(NASA-TT-F-13196) Avail: CFSTI CSCL 06F

The biogeochemical classification of plants and animals into zones and provinces on the basis of the various chemical elements in the soil and the ability of living matter to accumulate and synthesize these elements is discussed. Author

N70-38375# Vermont Univ., Burlington. Dept. of Psychology.
ISOLATION RESEARCH AND MOTIVATION THEORY
Donald G. Forgays Mar. 1970 26 p Presented to the Symp. on Arousal and Motivation Theory, Burlington, Vt., 8 Sep. 1969
(Contract F44620-69-C-0001)
(AD-706378; AFOSR-70-1410TR; TR-2) Avail: CFSTI CSCL 5/10

The report summarizes the early research of the Isolation Laboratory at the University of Vermont. Two forms of isolation experiences were studied, sound-proofed room exposure and under-water immersion. Results indicate that some subjects are able to tolerate the stresses of isolation much more than others and that these differences can be related to other behavioral and physiological factors. The relation of isolation research to general motivation theory is discussed. Author (TAB)

N70-38383*# Translation Consultants, Ltd., Arlington, Va.
COMPARATIVE BIOCHEMICAL STUDY OF MUSCLES [SRAVNITELNO-BIOKHIMICHESKOYE IZUCHENIYE MYSHTS]
I. I. Ivanov Washington NASA Sep. 1970 11 p Transl. into ENGLISH from the book 'Abiogenez i Nachalnyye Stadii Evolyutsii Zhizni' Moscow, Nauka Press, 1968 p 181–187
(Contract NASw-2038)
(NASA-TT-F-13195) Avail: CFSTI CSCL 06P

A study of adenosine triphosphate effects on muscle contractile systems is presented. Both live and macerated muscle fiber extractions were studied. The effect of ATP on calcium ion concentration was also investigated. Author

N70-38457# Human Engineering Labs., Aberdeen Proving Ground, Md.
EXPLORATORY STUDY OF PILOT PERFORMANCE DURING HIGH AMBIENT TEMPERATURES/HUMIDITY
Stephen Moreland and John A. Barnes Mar. 1970 88 p refs
(AD-707371; HEL-TM-6-70) Avail: CFSTI CSCL 6/19

The purpose of the study was to measure performance changes which may occur when Army personnel, wearing complete operational/combat flight clothing and equipment, fly a light observation helicopter during periods of high ambient temperature and humidity. Important relationships were found between physiological changes and crew station environment. An equation was developed to quantify a hypothetical relationship between performance, environment and physiological changes. Author (TAB)

N70-38497# North Dakota Univ., Grand Forks.
PROJECT THEMIS Annual Progress Report, 15 Jul. 1969–14 Jul. 1970
Russell H. Wilson and Francis R. O'Brien 1 May 1970 275 p refs
(Contract N00014-68-A-0499)
(AD-707449) Avail: CFSTI CSCL 8/1

A computer-controlled deep sea simulator is being designed to study ocean environmental effects on mammalian learning, memory, behavior, physiology, and biochemistry. An engineering and physiologic approach will be made to solve problems of biologic systems under environmental extremes. TAB

N70-38530# Advisory Group for Aerospace Research and Development, Paris (France).
A NON-INVASIVE TECHNIQUE OF CARDIO-PULMONARY ASSESSMENT. PART 2: ILLUSTRATIONS
D. M. Denison Aug. 1970 62 p
(AGARD-AG-143-70-Pt-2) Avail: CFSTI

This collection of graphs and illustrations depicts the various measurements performed for cardiographic pulmonary assessment to human subjects. The relationship between oxygen uptake and local oxygen pressure is explored in gas tension measurements of core, muscle, and mixed venous bloods on subjects in supine position and subjected to certain exercises. G.G.

N70-38531# Advisory Group for Aerospace Research and Development, Paris (France).
A NON-INVASIVE TECHNIQUE OF CARDIO-PULMONARY ASSESSMENT. PART 1: TEXT
D. M. Denison Aug. 1970 58 p refs
(AGARD-AG-143-70-Pt-1) Avail: CFSTI

The Cardio respiratory function is examined primarily in connection with a particular non-invasive test of this function. It describes a theoretical explanation of factors influencing gas tensions in mixed venous blood and their measurement together with the effects of various cardio pulmonary stresses. There is also a review of the work done in this field during the past two years. Author

N70-38567# Joint Publications Research Service, Washington, D.C.
EXPERIENCE OF INVESTIGATING THE MECHANISM OF THE EFFECT OF HYPOXIA ON ERYTHROPOIESIS
Ya. G. Uzhanskiy 8 Sep. 1970 8 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (Moscow), v. 15, no. 3, May–Jun.

1970 p 3-8
(JPRS-51327) Avail: CFSTI

It was demonstrated that a low partial oxygen pressure diminishes the mitotic activity of erythroblasts in bone marrow tissue cultures. The assumption that there may be a change in type of bone marrow metabolism, from oxidative to glycolytic in the presence of increased regeneration of blood was also ruled out by direct experiments. In addition, investigations involving the use of a micromethod for assaying gases in blood of animals following blood-letting revealed that in the presence of increased erythropoiesis a rather high oxygen content is maintained in bone marrow. Analogous findings were made on humans in the presence of anemia and polycythemia. In accordance with these data, it was demonstrated that in the presence of hyperoxic hyperoxia regeneration of blood is faster in animals with experimental anemia. These investigations led to the conclusion that in intact animals decrease in erythropoiesis in the presence of hyperoxia is related to adaptation of the organism to excessive oxygen in the form of economical erythropoiesis. Author

N70-38577# Eidgenossische Technische Hochschule, Zurich (Switzerland).
PLEUROTIN: STRUCTURE AND ADDITIONS, CONTRIBUTIONS FOR BIOGENESIS [PLEUROTIN: STRUKTUR UND BEITRAEGE ZUR BIOGENESE]
Hanspeter Schelling (Ph.D. Thesis) 1969 118 p refs In GERMAN
(DISS-4319) Avail: CFSTI

Investigated are structure and biogenesis of pleurotin, an effective antibiotic against gram-positive bacteria. Chemical reduction reactions and spectroscopic analyses of Pleurotus griseus extracts give the structural formula for the molecule and the relative configurations of five of the eight chiral molecular centers. X-ray analysis of the derivative confirms this chemical structure. Radioactive labeled inclusion experiments establish that: (1) all carbon atoms of pleurotin come from aceatate; (2) pleurotin takes up more than one mevalon acid unit; and (3) Pleurotus griseus can change farnesylchinon into pleurotin. Transl. by G.G.

N70-38654# Naval Aerospace Medical Inst., Pensacola, Fla.
ISONIAZID PROPHYLAXIS AS AN AVIATION RISK: PRELIMINARY REPORT
William W. Simmons and Rosalie K. Ambler 25 Nov. 1969 26 p refs
(AD-707126; NAMI-1095; NAVMED-MF12.524-005-5015B) Avail: CFSTI CSCL 6/15

The question of the advisability of aviation personnel continuing in duties involving the actual control of aircraft while taking prophylactic isoniazid was studied. Specifically, adverse side effects of the drug were looked for both subjectively and objectively while subject personnel continued aviation duties. Fifteen aviation personnel were studied with clinical, laboratory, and psychometric examinations for a total of 862.5 person-months of drug ingestion. No significant adverse side effects which were thought to constitute a hazard to the safe performance of flying duties were detected. Although the expected incidence of adverse drug effects from isoniazid is small and no significant effects were detected for this small sample, it is suggested that a large number of subjects be studied prior to formulating a statement of policy in this regard. Meanwhile, aviation duties for personnel undergoing 300-mgm isoniazid therapy are judged to be allowable provided the flight surgeon maintains close scrutiny over such men. The long duration of the isoniazid therapy makes it economically desirable to continue personnel in a flight status. Author (TAB)

N70-38838 National Lending Library for Science and Technology, Boston Spa (England).
AN ASSESSMENT OF CONDITIONS FOR HUMAN BEINGS IN THE OPEN AIR IN WINTER, WITH ALLOWANCE FOR THE MICROCLIMATE OF A BUILT-UP AREA
V. N. Adamenko et al 9 Apr. 1970 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 248, 1969 p 74-81
(NLL-M-9114-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Wind speed effects on the microclimate of cities and on the heat balance of human beings living in built-up areas are considered. Different combinations of air temperatures and wind speeds are reduced to a single index, representing heat emission from exposed parts of the body in calm conditions, for calculating the probable time of freezing necessary to induce frostbite in various climatic regions. Obtained relationships and nomograms can be used for estimating also the discomfort of a person's residence, depending on the type of built-up area, for which the wind field is known. G.G.

N70-38855# Hayes International Corp., Birmingham, Ala.
VALVE BIOLOAD REDUCTION AND STERILIZATION STUDY
A. N. James, Jr. and C. P. Houser 8 May 1968 40 p refs
(MD-226-68; R-ME-MM-97) Avail: CFSTI

Information is provided about existing contamination levels of hardware during manufacturing and assembly operations. The effect and effectiveness of certain decontamination and sterilization methods upon flight-accepted hardware are determined. A biostatistical method was designed and applied to provide a technique for data analysis. Author

N70-38858# Joint Publications Research Service, New York.
BIOLUMINESCENCE OF THE SEA
I. I. Gitelzon 24 Aug. 1970 11 p Transl. into ENGLISH from Biolyuminestsentsiya (USSR), 26 Nov. 1969 p 3-5, 153-159, 182-183
(JPRS-51226) Avail: CFSTI

Bathyphotometers were used to measure light emitted by plant and animal sea life. The measurements revealed the regularities in verticle and geographic distributions of biolumenscence, and the basic mechanisms determining its diurnal rhythm. Also revealed was the mechanism of chemical reactions leading to radiation, to derive in a pure form the substratum and fermet of reactions, and in many instances to reproduce it in vitro. Author

N70-38881# Library of Congress, Washington, D.C. Science and Technology Div.
AIR POLLUTION PUBLICATIONS: A SELECTED BIBLIOGRAPHY WITH INDEXES, 1966-1968
1969 532 p refs Prepared for Natl. Air Pollution Control Admin.
(Publ-979) Avail: SOD $4.50

The selected references cover emission sources of air pollution, measurement, control, effects on man, fauna, flora, and materials, air quality standards, legal and social aspects, and basic science and technology. The bibliography is arranged in subject categories and an author and subject index is provided. R.B.

N70-38900# Vermont Univ., Burlington. Dept of Psychology.
MAN IN ISOLATION AND/OR ENCLOSED SPACE: REPORT OF ACTIVITIES AT NATO SYMPOSIUM IN ROME, ITALY, 20-24 OCTOBER 1969
Donald G. Forgays and James M. Levin 1969 19 p refs
(Contract F44620-69-C-0001; Proj. Themis)
(AD-706377; AFOSR-70-1409TR; TR-1) Avail: CFSTI CSCL 5/10

A NATO symposium on man in isolation and/or enclosed space took place in Rome, Italy. The report summarizes the activities of the symposium, describes the more significant ideas

resulting from the symposium and follow-up activities, and outlines briefly a new program of research of apparent importance to space activities and other military and non-military systems. Author (TAB)

N70-38910 Oklahoma Univ., Norman.
EFFECTS OF EARMOLD ALTERATION UPON SOUND PRESSURE LEVELS GENERATED IN THE HUMAN AUDITORY MEATUS
Frank Douglas McDonald (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-18456

Investigated are sound pressure level (SPL) changes occurring in the human auditory meatus, as determined with a probetube microphone system, when an earmold having a standard form was modified to a form having a shortened-hollowed canal, a form having a shortened-hollowed-vented canal, and a form which was nonoccluding relative to the ear canal of the wearer. Two preliminary procedures were also accomplished which measured SPL's in couplers. One of these concerned measurements with a hearing-aid receiver placed directly upon the standard 2cc coupler. The other involved measurements in a special 2cc coupler, with earmold A interposed between the receiver and the 2cc cavity of the special coupler. Acoustical explanations of the findings are presented relative to the frequency-response curves of each measurement condition. Results of calculations of sound-power-transmission ratios expressed in decibel losses, Helmholtz resonators, and tube-length resonators are presented in order to explain the principal features of the response curves obtained under the various test conditions. Dissert. Abstr.

N70-38913# Naval Submarine Medical Center, Groton, Conn. Research Lab.
EFFECTS OF EXPOSURE TO INTENSE LOW FREQUENCY TONES ON HEARING AND PERFORMANCE Interim Report
Paul F. Smith, Martin S. Harris, Joseph S. Russotti, and Cecil K. Myers 26 Jan. 1970 10 p refs
(AD-707364; SMRL-610; NAVMED-MF12-524-004-9012D) Avail: CFSTI CSCL 6/19

Groups of men were exposed for a twenty-four hour period to either 70 Hertz tones at 112.8 plus or minus 10 dB re .0002 dynes/cm sq. or 300 Hertz tones at 113.4 plus or minus 3 dB re .0002 dynes/cm sq. During the exposure, performance on a sensory-motor task was tested periodically, and auditory threshold shifts were measured. Author (TAB)

N70-38924 National Lending Library for Science and Technology, Boston Spa (England).
TEMPORARY AND PERMANENT AUDITORY DECREASE AFTER DAMAGE TO HEARING CAUSED BY NOISE
F. Debaillie et al 2 Apr. 1970 10 p refs Transl. into ENGLISH from T. Soc. Geneesk., v. 46, no. 7, 1968 p 252 - 256
(NLL-CE-Trans-5305-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possibilities of recovery from auditory fatigue in the case of a group of 54 workmen exposed to a high, continuous noise level were examined. After the end of exposure four tests were made during work, and after 48 to 56 hours, 9 days, and 17 days rest. The progress of recovery from auditory fatigue was examined according to the degree of auditory injury, the number of years of exposure to noise, and the ages of the exposed persons. Author

N70-38958 National Lending Library for Science and Technology, Boston Spa (England).
POLLUTION OF ATMOSPHERIC AIR
M. M. Cernavskaja 24 Jun. 1970 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geog. (USSR), no. 5, 1969 p 134 - 136
(NLL-M-9197-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Air pollution is discussed on a world-wide basis. Two basic categories are considered: impurities coming directly from sources, and impurities formed in the atmosphere by the interaction of primary products with other primary products, or with components of the atmosphere. This latter is demonstrated by oxides of nitrogen and hydrocarbons, emitted by road transportation vehicles, exposed to solar radiation form photo-oxidants which have a harmful effect on organisms. A serious problem is considered the pollution of the upper layers of the troposphere and stratosphere, particularly as little is known about the diffusion and transport of impurities at these heights. The economic effects, such as more electric power consumption because of less natural illumination, loss in agricultural production, and sickness, are also discussed. F.O.S.

N70-38978 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE DYNAMICS OF CARDIAC OUTPUT IN PATIENTS WITH HEART DEFECTS, USING AN ULTRASONIC INTRAVASCULAR TRANSDUCER [ISSLEDOVANIE DINAMIKI SERDTSA PRI POMOSHCHI ULTRAZVUKOVONO VNUTRISOSUDISTOVO DATCHIKA]
A. A. Vishnevskii et al Jul. 1970 12 p refs Transl. into ENGLISH from Eksp. Khir. Anesteziol. (USSR), v. 13, no. 4, 1968 p 6 - 11
(NLL-RTS-5969) Avail: Natl. Lending Library, Boston Spa, Engl.: 22s or 4 NLL photocopy coupons

Hemodynamic properties of patients with heart diseases were studied by quantitative appraisal of their blood stream velocities in aortas and main vessels through introduction of ultrasonic transducers into cardiac chambers and femoral arteries. Measurements were analyzed for variations in intracardiac pressure, heart muscle potentials, heart wall movements, etc., throughout the cardiac cycle. G.G.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-37615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
FOAM-IN-PLACE FORM FITTING HELMET LINERS Technical Report, Jun. 1968 - Nov. 1969
Sidney Allinikov, John A. Ziegenhagen, and William H. Morton Apr. 1970 43 p
(AD-706402; AFML-TR-70-21) Avail: CFSTI CSCL 6/17

The feasibility of a foamed-in-place, form fitting foam helmet liner for Air Force crash or flying helmets was proven. Polyurethane foam helmet liners may be foamed-in-place directly on the flying crew members head, producing a perfectly fitting helmet liner with a minimum of time, labor, and inconvenience. A suitable polyurethane foam formulation was tailored to the specific requirements for the foam-in-place helmet liners. Design and fabrication of a suitable mold in which the helmet liner is foamed and which would be worn by the individual being fitted for a custom helmet liner during the foaming process, was accomplished. Author (TAB)

N70-37680# Air Force Systems Command, Brooks AFB, Tex. Human Resources Lab.
INNOVATIONS IN AIR FORCE TECHNICAL AND FLYING TRAINING

Horace H. Valverde Jun. 1970 31 p refs Presented at the Symp. on Evaluation of Educational Technol. Appl., Annapolis, 22 - 26 Jun. 1970
(AD-707511) Avail: CFSTI CSCL 5/9

Two innovations in technical and flying training are described. The first is an application of the systems approach to electronics maintenance training. The systems approach resulted in a fourteen-week course. The conventional course required twenty four weeks. Graduates of the two courses were compared on various criteria. The second effort pertains to the development and evaluation of audio/video recordings in undergraduate pilot training. Equipment mounted in the aircraft produced audio/video recordings that were of substantial help to the students when viewed after flight. Author (TAB)

N70-37685# Army Behavior and Systems Research Lab., Arlington, Va.
COMPARISON OF COMPUTER-SIMULATED CONVENTIONAL AND BRANCHING TESTS
Carrie W. Waters Mar. 1970 42 p refs
(AD-707375; BESRL-TRN-216) Avail: CFSTI CSCL 5/10

In the usual testing situation, each examinee takes all the items, and item sequence is the same for each examinee. It is possible, however, to have sequential or branching tests in which all examinees do not take te same items and the sequence of item presentation for an individual is some function of his performance on previous items; that is, an item answered correctly is followed by a more difficult item, an item answer incorrectly, by a less difficult item. The rationale for the latter procedure is that presentation of items based on an examinees past performance allows each individual to take items that are progressively more appropriate to his own level of ability. It is conceivable that such a procedure would reduce testing time, and for a given amount of time would permit more accurate measurement of an individuals ability, principally by reducing opportunities for chance success by low ability examinees attempting items too difficult for them. Author (TAB)

N70-37714# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ANTHROPOLOGICAL APPLICATIONS IN HIGH ALTITUDE FLIGHT SYSTEMS
Milton Alexander, John W. Garrett, and Joan C. Robinette Mar. 1970 19 p refs
(AD-706888; AMRL-TR-70-3) Avail: CFSTI CSCL 5/5

The report reflects research on various phases of the dimensional requirements of the pressure suited man in the man-machine system. The spatial requirements for the man in a cockpit or capsule and an ejection and escape mechanisms or wearing clothing as protection against hostile environmental factors, such as heat, cold, vacuum, high g, and radiation, present separate problems for the design engineer that can be helped effectively with the applicable anthropological data. Author (TAB)

N70-37718# Naval Aerospace Medical Inst., Pensacola, Fla.
PRELIMINARY REPORT ON A TEST OF MECHANICAL COMPREHENSION
John T. Evans (Boston Naval Hospital) Mar. 1970 10 p
(AD-707125; NAMI-1103; NAVMED-MF12-524-002-5001D) Avail: CFSTI CSCL 5/9

Discrepancies between mechanical comprehension test scores and later performance by aviators suggested that paper-pencil tests do not measure the type of mechanical comprehension required of the aviator. The problem was to devise a mechanical task that would include more of the specific elements required in the pilots job. Author (TAB)

N70-37722# Army Natick Labs., Mass. Food Lab.
FREEZE-DRYING OF FOODS FOR THE ARMED SERVICES
J. M. Tuomy Feb. 1970 53 p refs
(AD-706900; FL-107; TR-70-43-FL) Avail: CFSTI CSCL 6/8

The report reviews the development and use of freeze-dried food products for the Armed Services. It covers the various products and ration systems that have been developed, the basic parameters of freeze-drying and freeze-dried foods, commercial freeze-drying facilities, compression of freeze-dried foods, and development of freeze-dried foods for astronaut feeding. The report is non-technical and includes a selected bibliography for persons wishing to go more deeply into the technical aspects of freeze-drying. Author (TAB)

N70-37744# Coast Guard, Baltimore, Md. Field Testing and Development Center.
VISUAL SIGNAL EVALUATOR
Guy P. Clark 4 May 1970 33 p
(Contract DOT-CG-92450-A)
(AD-707187; USCG-509) Avail: CFSTI CSCL 6/2

The Visual Signal Evaluator (VISE) is a device designed and constructed by Bio Technology, Incorporated, Falls Church, Virginia. Through use of a beamsplitter in the field of view, an effective point source (signal) light is superimposed on that field of view. Controls allow for varying color, intensity, and flashing characteristics of the superimposed light. This report presents an evaluation of the VISE. Author (TAB)

N70-37808 Wisconsin Univ., Madison.
SYNTHESIS OF AN INTERACTIVE HUMAN-MACHINE SYSTEM
John James Lenahan (Ph.D. Thesis) 1969 216 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-12389

The design, analysis, and application are discussed for an interactive human-machine system that operates as a real-time control/time-sharing system. The system-state model, which is used to integrate design, analysis, and application is developed. The system-state model is stated initially in abstract terms using sets, then reformulated using principles of directed graphs, matrix notation, and information which describes the timing, processing and control within individual system components. Basic concepts that are introduced include system-state, system-state diagram, subsystem level, cycle time, function level, priority level, transition condition and transition time. Four basic matrices, defined as the transition, system-state control, system and system control matrices, provide the computational capability of the model. Together, the basic concepts plus the matrices form a quantitative, integrated construct for designing and evaluating a wide range of systems including both human-machine and machine-machine configurations. Dissert. Abstr.

N70-37893# Martin Marietta Corp., Orlando, Fla.
TARGET ACQUISITION STUDIES: VISUAL ANGLE REQUIREMENTS FOR TV DISPLAYED TARGETS Final Report, May 1969 - May 1970
James W. Bergert and Frank D. Fowler May 1970 74 p refs
(Contract N00014-67-C-0340)
(AD-706369; OR-10689) Avail: CFSTI CSCL 5/5

The objective of the study was to determine the smallest angle that an object viewed on a television display could subtend at the observers eye and be detected or recognized as a target. Tests were conducted using both static and dynamic modes to provide a data baseline for the dynamic conditions simulating aircraft flight. Television field-of-view, target-to-background contrast and target background areas were varied for the detection and recognition tasks at briefed target positions. A significant finding of this study related performance to introduction of the dynamic factor. Author (TAB)

N70-37928# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
DEVELOPMENT OF A TRAINING PROGRAM FOR MEDICAL-ENGINEERING TEAMS
A. W. Siegel *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 29 - 33 (See N70-37926 21-34)
Avail: Issuing Activity

Scope and objective of the training program seminar for medical-engineering teams covered theoretical, experimental, and real-world aspects of highway collision investigation and reconstruction. Emphasis was placed on occupant kinematics and assessment of design for injury reduction. Accident cause was studied in terms of environment, driver, and vehicle factors. Author

N70-37964# Washington Univ., St. Louis, Mo.
THE EFFECT OF FATIGUE ON VISUAL SEARCH ACTIVITY IN HELICOPTER PILOTS Annual Summary Report, 1969 - 1970
John A. Stern 1970 49 p ref
(Contract DA-49-193-MD-27)
(AD-706239; ASR-1) Avail: CFSTI CSCL 6/16

The major efforts were focused (a) on extending the manual data analysis to portions of the flight not previously evaluated (during take-off and during landing); (b) the development of computer programs to allow for the more efficient and reliable reduction of such data; and (c) the development of computer programs to allow for data reduction and representation otherwise not feasible. Author (TAB)

N70-38022# Naval Aerospace Medical Inst., Pensacola, Fla.
VISUAL DISTORTION: A POINT OF VIEW
Robert S. Kennedy 6 Jan. 1970 34 p refs *Its* Monograph No. 15
(AD-707064) Avail: CFSTI CSCL 6/16

The first part of the paper is an overview of the visual distortion literature, with a discussion of its role in the study of perceptual development. The second part offers a framework in which to view the effects of visual distortion. In addition, a possible mechanism for the explanation of the disturbing effects which result, and the subsequent adaptation to them, is suggested. The description of the mechanism is molar, although speculations about anatomical locus and neuronal components are included. Author (TAB)

N70-38039# Naval Medical Field Research, Camp Le Jeune, N.C.
EVALUATION OF A PROTOTYPE UNIT FOR TELEMETRY OF RECTAL TEMPERATURES
Wade G. Holcomb and Philip J. Rasch Apr. 1970 19 p refs *Its* Vol. 20, No. 5
(AD-706329) Avail: CFSTI CSCL 6/2

Studies were conducted to determine whether pulsed tone burst (A2 emission) would provide acceptable data during the telemetering of body core temperatures under actual field conditions. It was determined that it provided usable temperature data at ranges up to 1,000 yards in hilly terrain and up to 600 yards in dense scrub. Author (TAB)

N70-38129# Toronto Univ. (Ontario). Inst. for Aerospace Research.
FLIGHT TRANSPORTATION
In its [Inst. for Aerospace Res.] Nov. 1969 p 113 - 115 (See N70-38116 21-01)
Avail: CFSTI

Summaries of research of Canadian air transportation are presented. Topics discussed include measurement of human pilot performance for tracking, and a study of short haul air transportation. F.O.S.

N70-38161# George Washington Univ., Alexandria, Va. Human Resources Research Office.
DETERMINATION OF SELECTED COSTS OF FLIGHT AND SYNTHETIC FLIGHT TRAINING
Oran B. Jolley and Paul W. Caro, Jr. Apr. 1970 45 p refs
(Contract DAHC19-70-C-0012)
(AD-706764; HumRRO-TR-70-6) Avail: CFSTI CSCL 5/9

As part of an analysis of the value of synthetic training at the U.S. Army Aviation School, costs associated with the conduct of flight and synthetic training in the instrument phase of the Armys Officer/Warrant Officer Rotary Wing Aviator Course were identified and computed separately for each type of training. It was found that, for the factors considered, the hourly cost of flight training at the time of this study (September 1966) was approximately six times as great as the corresponding cost of synthetic flight training. The report describes the sources for and the treatment of data, and the major assumptions made in allocating the costs. Author (TAB)

N70-38205# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
THE SELECTION OF LOCAL FEATURES FOR PATTERN IDENTIFICATION: AN EXPLORATORY STUDY
D. W. Hastings and Selby H. Evans Aberdeen Proving Ground, Md. HEL Mar. 1970 25 p refs
(Contract DAAD05-68-C-0176)
(AD-707370; HEL-TM-5-70) Avail: CFSTI CSCL 5/10

A feature analytic process is proposed as a basic mechanism in the encoding and storage of visual shapes by humans. It is hypothesized that local features, encoded as feature prototypes plus deviations, are stored in memory according to their positional relationships in the pattern. Two studies explored methodologies for the study of feature selection and attempted to determine if humans would agree in their selection of features. Inspection of the results showed that humans do agree in their selection of features and tend to repeat the selection of similar visual configurations as features across patterns. It is proposed that the consistency of feature selection, both within and between patterns, is a function of both the informational properties of the feature and the population of features present in the patterns. Author (TAB)

N70-38209# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
FURTHER APPLICATIONS OF THE RANDOM ADAPTIVE MODULE (RAM) SYSTEM TO SCHEMA THEORY
Bill R. Brown and Selby H. Evans Aberdeen Proving Ground, Md. HEL Mar. 1970 41 p refs
(Contract DAAD05-68-C-0176)
(AD-707369; HEL-TM-4-70) Avail: CFSTI CSCL 5/10

The purpose of this investigation was the further development and assessment of a model for schematic concept formation. A computer simulation of the model, extended to include a higher-order pattern-representation unit, was used to make quantitative predictions of human performance in two mixed-schemata discrimination tasks. The simulations successfully predicted both the gross and detailed characteristics of human schematic concept formation. These results thus support the suggestion that the Random Adaptive Modules basic components may be useful in constructing models for performance in a variety of tasks related to schema theory. Author (TAB)

N70-38302# Adaptronics, Inc., McLean, Va.
LARGE NEUROTRON NETWORKS Final Technical Report, 1 May 1968 - 30 Apr. 1969
Lewey O. Gilstrap, Jr. Wright-Patterson AFB, Ohio AMRL Mar. 1970 46 p refs
(Contract F33615-68-C-1395)
(AD-706855; AMRL-TR-69-92) Avail: CFSTI CSCL 6/4

Studies of neuromime network systems are presented. These studies include a prelogical exploration of goal-directed behavior to find a possible starting point for the development of a theory of such systems. Closed-loop behavior in neuromime nets is examined using a pulse-density model of a neuron. Several very simple closed-loop problems are analyzed using the technique and some rules established for analyzing more complex problems. Mechanization of neuromime nets using multiplexed neuromimes to give the effect of a large number of neuromimes is investigated for the case of spatially distributed pulse density codes, such as those that are provided by the retina of the eye. Author (TAB)

N70-38309*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DISCUSSION OF MANUAL CONTROL PROBLEMS
James H. Golmon 27 Dec. 1968 33 p refs
(NASA-TM-X-53906; IN-AERO-68-7) Avail: CFSTI CSCL 05H

Compensatory and pursuit tracking systems are discussed in relation to operator tasks. Motor coordination is analyzed using a muscle and nerve model. Mental tracking processes are mentioned along with eye and hand responses. Human operator characteristics are affected directly by the forcing function, manipulator dynamics, and controlled element dynamics. Other factors affecting the operator indirectly are environmental variables such as illumination and temperature, training, fatigue, and motivation. Quasilinear models of human operators are given for adaptation and optimization. The time delay term results from nerve conduction, human sensor excitation, computational lags, and other data processing activity in the central nervous system. The neuromuscular lag varies with task. The equalization characteristic and gain are the major elements in the human transfer function which allow the operator to stabilize differing dynamic devices. Problems with the quasilinear model include operator: response time, extrapolation compensation, behavior as a discrete or sampling system, and discontinuous behavior. Simulation studies on the feasibility of using astronauts in the attitude control loop during Saturn 5 propelled phases are cited. J.M

N70-38339# City Coll. of the City of New York. Dept. of Physics.
TOWARD FORMULATION OF CRITERIA FOR IMAGE ENHANCEMENT, PART 2 Final Report, Mar. 1969 – Feb. 1970
Leo Levi Feb. 1970 185 p refs
(Contract N00014-69-C-0370)
(AD-706413) Avail: CFSTI CSCL 6/16

The investigation was aimed at establishing criteria for evaluating image enhancement techniques. The degree of enhancement was evaluated in terms of the amount of information (in the colloquial sense) transferred to the final detector. Special attention was given to those systems in which the human visual system is the final detector. The investigation was divided into three areas: (1) The establishment of abstract criteria for enhancement and the formulation of expressions for the optimum under given restrictions; (2) Application of these results to practical enhancement techniques - finding the expression for optimization for each one; (3) Formulating the performance of the human visual system in communication-theoretic terms and finding the values of the relevant parameters to permit the application of the results of Area (2) to systems involving visual detection. Author (TAB)

N70-38456# Human Engineering Labs., Aberdeen Proving Ground, Md.
US ARMY PRIMARY HELICOPTER SCHOOL: TRAINING PROGRAM PERFORMANCE NORMS
John A. Barnes and Flavous D. Statham Apr. 1970 90 p refs
(AD-707372; HEL-TM-8-70) Avail: CFSTI CSCL 5/9

The helicopter pilot training program of the Army differs from those of the other services in concept; it takes nonpilot servicemen and trains them to fly helicopters. The study provides normative performance data for a pilot trainee in an Army light observation helicopter as a first step toward establishing normative data for pilot performance in all Army helicopters. Author (TAB)

N70-38460# Sperry Rand Corp., Great Neck, N.Y. Sperry Gyroscope Div.
VISUAL REQUIREMENTS STUDY FOR HEAD-UP DISPLAYS Final Report, Apr. 1966 – Mar. 1970
Theodore Gold and Aaron Hyman Mar. 1970 79 p refs
(Contract N00014-66-C-0114)
(AD-707128; SGD-4283-0333; JANAIR-680712) Avail: CFSTI CSCL 5/8

An experimental study was conducted to determine critical values of the essential optical and electronic design parameters for head-up displays based on the visual requirements of the pilots who will use these displays. This information will provide a basis for future specifications covering this type of display. The investigation covered two areas, size of exit pupil and binocular disparities due to optical distortions. The exit pupil study was conducted in a flight simulator in which a wide field (25 degrees) head-up display with a large aerial exit pupil was installed. Four pilots with military flight experience served as test subjects. The results indicate that the minimum size of exit pupil required is three inches in diameter, for wide-field systems in which the pilots head position is no more than 10 inches behind the exit pupil. Author (TAB)

N70-38473# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE ANTHROPOLOGY OF ANTHROPOMORPHIC DUMMIES
H. T. E. Hertzberg 1970 24 p refs Presented at the 13th Stapp Car Crash Conf., Boston, 2–4 Dec. 1969 Submitted for publication
(AD-706411; AMRL-TR-69-61) Avail: CFSTI CSCL 5/5

The paper describes anthropological aspects of a cooperative program to create a family of anthropomorphic dummies representative of the American population. The dummies are for use in crash-tests to improve public safety in motor vehicles. The anthropomorphic dummy is that type which closely approximates a given percentile level of the human body in size, form, segment mobility, total weight, segment weight, weight distribution and resiliency of its flesh covering, and is usually able to withstand 100G. The history of this development is briefly sketched from its beginning in 1949. In the current program, the best available data have been chosen for three adult sizes: the 95th- and 50th-percentile males, and the 5th-percentile female. The body-forms being sculptured will provide a set of national standards for size, shape and weight. Future phases will involve the development of dummy organ-masses approximating the sizes and vibratory responses of those in the living torso. Deficiencies of the anatomical, anthropometric, biomechanical and physiological data used for these body-forms are noted, and suggestions are made for improvement, so that future dummies may be made more reliably representative of the using population. Author (TAB)

N70-38501*# Lockheed Missiles and Space Co., Palo Alto, Calif.
TRACE CONTAMINANT ADSORPTION AND SORBENT REGENERATION
A. J. Robell, C. R. Arnold, A. Wheeler, G. J. Kersels, and R. F. Merrill Washington NASA Sep. 1970 290 p refs
(Contract NAS1-5847)
(NASA-CR-1582; LMSC-L-62-69-1) Avail: CFSTI CSCL 06K

The adsorption and desorption characteristics of activated carbon were experimentally and theoretically investigated in order to determine the applicability of regenerable sorption to the control of airborne trace contaminants within spacecraft cabins for long mission durations. Capacity correlations for pure and mixed contaminants were established. A theory was derived and successfully

tested for vacuum desorption rates from single particles and beds. A quantitative design methodology was developed for the practical design of regenerable systems. Author

N70-38527# Bureau of Mines, Pittsburgh, Pa. Safety Research Center.
EVALUATION OF CHEMICAL-CARTRIDGE RESPIRATOR FACE FIT
Harold A. Watson, Patricia M. Gussey, and Albert J. Beckert Sep. 1970 11 p refs
(BM-RI-7431) Avail: Issuing Activity

A method for measuring leakage of vapors into a chemical-cartridge half-mask facepiece during simulated use is described. The respirator, fitted with high-efficiency cartridges, is worn in a dichlorodifluoromethane air test mixture while a series of timed activities (facial movements, varied breathing, exercise, etc.) is performed. Complementing other tightness tests, this method is useful particularly for studying face fit and the effect of facial movements on leakage. The concentration of CCl2F- within the facepiece is monitored continuously to observe the immediate effect of physical activity on leakage. A composite sample is collected simultaneously in a plastic bag as a measure of average leakage during the 18-minute test period. Leakage, reported as percent, is calculated from the concentrations of CCl2F2 within the facepiece and in the test atmosphere. Author

N70-38556# Joint Publications Research Service, New York.
ARTIFICIAL AND SYNTHETIC FOODS
A. Nesmeyanov 28 Aug. 1970 10 p Transl. into ENGLISH from Nauka i Zhizn (USSR), No. 6, 1970 p 29-32
(JPRS-51260) Avail: CFSTI

Finding quickly usable sources of food, primarily protein, for the increasing world population is discussed as the task of biologists, agriculturalists, and chemists. It is shown that the losses of protein in meat animal husbandry approximate 90%, and the elimination of the middle link, i.e. the animal, is desirable. The protein content of various foods are analyzed in terms of a balanced diet. Yeast proteins currently used in animal husbandry are suggested as a protein for human consumption. The problem of developing a flavorable and tasty dish is not considered as difficult as creating appetizing odors. A suggested simple method of using yeast protein is its addition to structureless foods such as flour and similar products. F.O.S.

N70-38693# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N.Mex.
PROTECTIVE MEASURES AGAINST ACCIDENTAL DECOMPRESSION IN SPACE AND ATMOSPHERIC FLIGHT
Harold J. von Beckh Mar. 1970 70 p refs
(AD-705563; Rept-6571-ARL-TR-70-4) Avail: CFSTI CSCL 6/19

Rapid decompression experiments with humans and animals are synthesized in up-to-date tables and the etiology and symptomotology of the decompression syndrome including the subsequent hypoxic stress are discussed. Special consideration is given to Time of Useful Consciousness (TUC) and Total Rescue Time (TRT), as limiting factors for rescue operations. Compartmentalization is suggested as a protective measure for both spacecraft and stratospheric aircraft; the operational aspects are discussed in detail. Division of space stations into two or more compartments, which are separated by airlocks, would offer additional advantages such as (1) the possibility to conduct controlled decompressions in case of fire or contamination by noxious agents in one of the compartments, (2) use of the airlock as a hyperbaric chamber for immediate therapy of decompression victims, and (3) use of the airlock as a radiation shelter during periods of increased radiation intensity. For the protection of crews who are exploring the surface of another planet or the moon, it would be desirable to provide easily transportable, lightweight, Minishelters, consisting of a small pressurized compartment with an airlock. As the exploratory expedition advances, these shelters should be distributed like relays on strategic points in order to assure recompression of the explorers before TRT has elapsed. International standardization of spacecraft components such as entrance hatches, electronic monitoring devices, and life support components is suggested. Author (TAB)

N70-38873# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
FOOT OPERATION OF CONTROLS: SPEED OF ACTIVATION AND EXERTION OF FORCE TO PEDALS. PERCEPTION, SPEED AND ACCURACY OF LEG AND FOOT MOTIONS
K. H. E. Kroemer Feb. 1970 40 p refs
(AD-707142; AMRL-TR-69-57) Avail: CFSTI CSCL 5/8

The literature pertaining to foot operation of controls is reviewed and a new experiment is reported. Published experimental results clarify only some isolated aspects of leg and foot motions. Even the relatively often investigated speed of operating pedals and forces that can be applied to them have been studied under such different experimental conditions that no general statements are possible concerning what pedal can be operated most quickly or forcibly. Opinions about the advantages and disadvantages of hand versus foot operation do not appear to be based on experimental findings. In an experiment, seated young adult male subjects moved the right foot as rapidly as possible over distances of 15 cm to circular targets. The direction of these discrete movements was studied for accuracy of motion. Author (TAB)

N70-38917# Army Foreign Science and Technology Center, Washington, D.C.
MAN AND TECHNOLOGY. ESSAYS ON ENGINEERING PSYCHOLOGY [CHELOVEK I TEKNIKA. OCHERKI INZHENERNOY PSIKHOLOGII]
B. F. Lomov 9 Feb. 1970 555 p refs Transl. into ENGLISH from Chelovek i Tekhn. Ocheri Inzh. Psikologii (Moscow), 1966 p 1-463
(AD-706544; FSTC-HT-23-827-70) Avail: CFSTI CSCL 5/5

The book gives a description of the basic problems of engineering psychology, notes the experimental data which have been accumulated and indicates certain ways for accomplishing future research. It examines the most general characteristics of man as an element of a control system, the speed, accuracy, and reliability of his actions. Attention is directed to problems of receiving and processing information by man. These deal with the physical properties of the signal involved, evaluation of the quantity of information man can receive, and finally by what psychic such information is received. The major emphasis of the book is on the interaction of men and machines in a control system. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-37610*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
OXYGEN COMPLEXES FORMED AT 4 K
R. C. Reid and F. Wong Jun. 1970 37 p
(Grant NGR-22-009-312)
(NASA-CR-112765; Rept-2) Avail: CFSTI CSCL 07D

To test the patent claims that oxygen could be complexed so that it would be stable in the solid form at relatively high temperatures, three component gases were tested for their ability to form such complexes; these were nitrogen tetroxide, Freon-22, and carbon dioxide. Oxygen and the component gas were quickly solidified in a cryogenic chamber at 4.2 K. The resultant product was slowly heated, and the temperature and quantity of gas evolved from the product were continuously measured. It was found that oxygen was not complexed by the nitrogen tetroxide, Freon-22, or carbon dioxide. These findings lend doubt to this proposed method for the storage of oxygen. Author

N70-37645# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
MECHANISMS OF SUBSTITUTION REACTIONS OF METAL Technical Progress Report, 1969 - 1970
Fred Basolo and Ralph G. Pearson 20 Apr. 1970 34 p refs
(Contract AT(11-1)-1087)
(COO-1087-130) Avail: CFSTI

The symmetry properties of molecular structures are studied for predicting the activation energy of chemical reactions. Several reactions are reported including the following: cleavage reactions of acylmetal and alkylmetal derivatives, rates of substitution of molecular nitrogen complexes, electrophilic reactions of tetrakis metal of nickel triad, and stereochemistry of induced aquatic reactions of chromium (III) complexes. F.O.S.

N70-37656# Boeing Scientific Research Labs., Seattle, Wash.
RARE GAS PLASMA POLYMERIZATION OF ORGANIC COMPOUNDS AT -196 C I BENZENE
John R. Hollahan Apr. 1970 13 p refs
(AD-706609; D1-82-0967) Avail: CFSTI CSCL 7/5

Benzene in a frozen solid state at -196C has been polymerized by a rare gas radiofrequency plasma of helium. The resulting polymer shows no sign of aromaticity. Infrared spectra suggest the polymer is a branched, aliphatic hydrocarbon polymer with some unsaturation and crosslinking. The formation of the polymer is best explained by the cission of a single bond in the benzene molecule with the formation of the 1,3,5,-hexatriene biradical. The biradicals combine with themselves and with ethyl groups presumed to derive from further fragmentation and hydrogen abstraction from benzene molecules. Author (TAB)

N70-37675# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
MOESSBAUER EFFECT STUDY OF THE LAVES PHASES (Fe(1-x)Mn(x))2Ti
T. E. Sharon and C. C. Tsuei Jun. 1970 22 p refs
(Contract AT(04-3)-822)
(CALT-822-6) Avail: CFSTI

The Moessbauer spectra of a series of Laves phases (Fe(1-x)Mn(x)2Ti were measured at 77 K and 300 K. The results were interpreted in terms of a two site model, representing the two inequivalent positions for Fe atoms in the unit cell. This analysis indicates that Fe and Mn do not substitute randomly into the two sites. The variation of the isomer shift with composition is not adequately described by scaling the electronic charge density with volume. Author

N70-37700# Duquesne Univ., Pittsburgh, Pa. Dept. of Chemistry.
COMPLEXES IN CHEMISTRY Final Report
Norman C. Li Dec. 1969 9 p refs Sponsored by AEC
(NYO-1922-49) Avail: CFSTI

The nature and stability of the binary and ternary complexes are investigated in the synergic extraction of metal ion from aqueous to organic phases containing beta-diketone and neutral additive. Cobalt and zinc extraction with thenoyltrifluoracetone and trioctylamine is presented. Proton magnetic resonance evidence in carbon tetrachloride medium is given for keto hydrate formation in beta-diketones and organophosphorus compounds. Infrared studies amine complexes with organophosphorus compounds are examined. Lanthanide complex stability with bimalonate and bisuccinate and the sulphuric acid, water, tributyl phosphate, carbon tetrachloride system were studied, as well as the Mossbauer spectra of iron(III) citrate complexes. J.A.M.

N70-37706# California Univ., Berkeley. Lawrence Radiation Lab.
A NOTE ON THE POSITION OF THE "GOLD 5d BANDS" IN Au Al2 AND Au Ga2
P. D. Chan and D. A. Shirley Dec. 1969 11 p refs Presented at Density of States Symp., Washington, D.C., 3-6 Nov 1969; sponsored by NBS Supported in part by AEC
(UCRL-19519; CONF-691123-1) Avail: CFSTI

To help resolve the 'd-band dilemma,' measurements of the valence-band spectra of AuAl 2 and AuGa2 was undertaken by X-ray photoelectron spectroscopy. The results are basically in good agreement with previous band structure and X-ray spectra results, but some differences are also apparent. It is found that the gold 5d bands in the AuAl 2-type alloys lie 6 to 8 eV below the Fermi energy. P.A.B.

N70-37717# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF HELIUM MOLECULAR SPECTRA Final Report, 29 Jan. 1969 - 31 Jan. 1970
Alex Dalgarno, Kenneth M. Sando, and Arthur C. Allison Apr. 1970 67 p refs
(Contract F19628-68-C-0234)
(AD-707130; AFCRL-70-0249) Avail: CFSTI CSCL 7/4

A detailed interpretation is presented of the measured ultraviolet absorption and emission spectra of the helium molecule. A potential-energy curve is derived for the A singlet Sigma(u)(+) state that has a potential barrier of height 0.049 eV at a separation of 3.1 A and a potential well of depth 2.50 eV at a separation of 1.04 A. It is argued that the emission spectrum is due primarily to quasi-bound resonating vibrational states. Quantitative values for the absorption coefficient of colliding helium atoms are given. Some calculations on the effect of shape resonances in the photodissociation of H2 are described. An investigation of the effects of centrifugal distortion on discrete transition probabilities in the Lyman system of H2 is reported. Author (TAB)

N70-37724# Princeton Univ., N.J.
DEPARTMENT OF CHEMISTRY Annual Progress Report, 1 Jun. 1969 - 31 May 1970
31 May 1970 6 p refs
(Contract AT(30-1)-1158)
(NYO-1158-33) Avail: CFSTI

Work reported includes research in the following fields: molecular sieves (zeolites) in catalytic reactions; magnetic resonance work on zeolites and charcoal; ESR studies of the adsorption on gold of TEMPO, a spin labelling stable organic radical widely used to characterize the nature of local molecular environment; the behavior of silicic acid studied by the proton resonance of the water it encloses; and laser Raman spectroscopy studies investigating the nature of finely divided catalysts and, in particular, porous Vycor glass. P.A.B.

N70-37728# RAND Corp., Santa Monica, Calif.
THE THERMODYNAMICS OF THE ZIRCONIUM NITRIDE/ZIRCONIUM-NITROGEN VAPOR SYSTEM
F. J. Krieger Apr. 1970 36 p refs
(Contract F44620-67-C-0045)

(AD-706886; RM-6295-PR) Avail: CFSTI CSCL 7/4

The study considers zirconium nitride over a range of temperatures up to 6000 deg K and pressures up to 100 atmospheres. Two sets of equilibrium composition equations are used--one representing a pure gas phase, the other a heterogeneous system of gas and condensed solid or liquid ZrN. The gas phase of the heterogeneous chemical system, like the homogeneous gas phase, comprises eight gaseous zirconium-nitrogen species. Computational results are presented in both graphic and tabular form. The former is a conventional Mollier diagram in which specific enthalpy is plotted against specific entropy, with cross plots of temperature, pressure, and molecular weight or moles of condensed ZrN. Author (TAB)

N70-37729# Adelaide Univ. (Australia). Dept. of Physics.
ATOMIC AND MOLECULAR PHOTODISINTEGRATION Final Report
John H. Carver 31 May 1970 7 p refs
(Grant AF-AFOSR-1568-68)
(AD-707553; AFOSR-70-1390-TR) Avail: CFSTI CSCL 7/4

Partial photoionization cross sections are measured over a range of wavelengths using a photoelectron spectrometer and scanning ultraviolet monochromator. Measurements have been made with gases of importance in planetary atmospheres, and in some cases a detailed study of preionizing decay processes has been made. A windowless differentially pumped absorption cell with digital detection and data handling systems has been developed for photoabsorption measurements in the Lyman and Werner bands in molecular hydrogen. Author (TAB)

N70-37735# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
DETERMINATION OF NITROGEN IN BORON NITRIDE
L. D. Keele 11 May 1970 12 p refs
(Contract W-7405-eng-26)
(Y-1718) Avail: CFSTI

High-fired boron nitride reacts with six-molar sulfuric acid and potassium perchlorate when the mixture is heated in a sealed glass tube for four hours at 350 C. The resulting ammonium-type nitrogen is contained in a clear solution that is suitable for analysis using a modified Kjeldahl apparatus. Author

N70-37739# New York Univ., N.Y. Dept. of Chemistry.
THERMIONIC EMISSION BY SOLUTIONS OF SOLVATED ELECTRONS
Bill Baron, Paul Delahay, and Roberto Lugo Mar. 1970 32 p refs Submitted for publication
(Contract Nonr-285(65))
(AD-707534; TR-12) Avail: CFSTI CSCL 7/4

Solutions of solvated electrons (generated by dissolution of sodium) in hexamethylphosphoric triamide in a nitrogen atmosphere exhibit thermionic emission. This process was established on three counts: near perfect rectification at the solution-gas interface; measurement of the drift velocity of charge carrier in the gas between solution and collector; analysis of electrical conduction in the gas phase. Measured currents were corrected for the Schottky effect and for back scattering of electrons in the gas phase. Changes in surface potential of less than 0.1 V, for two simple limiting cases, account for experimental results. The temperature dependence of current yielded an energy of 1.0 eV. This energy includes the work function and contributions from solution and interfacial equilibria. Techniques are described, and ancillary measurements of solution conductivity are reported. Author (TAB)

N70-37742# New York Univ., N.Y.
ELECTRONIC STRUCTURE OF ORGANIC MOLECULES AND ORGANIC SEMICONDUCTORS Final Report, 1 Jul. 1967 - 31 Dec. 1969
Jules W. Moskowitz 31 Dec. 1969 50 p refs
(Contract F44620-67-C-0089)
(AD-706875; AFCRL-70-0222) Avail: CFSTI CSCL 7/4

A powerful, flexible system of computer programs was developed for the computation of self-consistent-field wavefunctions for small polyatomic molecules in a gaussian basis. Accurate wavefunctions were computed for water, formaldehyde, and ethylene. A preliminary investigation of the electronic structure of an ethylene dimer in the exciton model was carried out. Author (TAB)

N70-37766# University of Southern Calif., Los Angeles.
AQUEOUS CHEMISTRY OF FREE RADICALS AND OTHER INORGANIC REACTIVE INTERMEDIATES Progress Report, 1969 - 1970
Wayne K. Wilmarth 1970 25 p refs
(Contract AT(11-1)-113)
(USC-113-P-4-16) Avail: CFSTI

Photolytic generation of highly reactive radicals in inorganic glasses at 77 K is discussed. In most of the experiments the radicals were generated by 2537 A photolysis of approximately 0.001 M solutions of H202, S208(--), or HnP208(-4+n). Progress for other projects is outlined including studies of: reactive free radicals in aqueous inorganic glasses at low temperatures by ESR and visible or UV spectroscopy, reaction kinetics involving OH, SO4- and HnPO4(-2+n) radicals, and Co(3) peroxide and superoxide complexes. J.M.

N70-37767# California Univ., Los Angeles. Dept. of Chemistry.
VACUUM ULTRAVIOLET AND PHOTOIONIZATION STUDIES ON OLEFINS
Daniel Amadeo Demeo (Ph.D. Thesis) 1969 229 p refs
(Contract AT(11-1)-34)
(UCLA-34-P-91-37) Copyright. Avail: CFSTI

Vacuum ultraviolet absorption and photoionization studies which were carried out on a number of alkyl-substituted, endocyclic, exocyclic and bicyclic olefins are presented. Vacuum ultraviolet absorption spectra show a transition in the 55 - 60,000/cm region, due to the excitation of one of the pi-electrons of the double bond to an antibonding pi^*-orbital. The frequency of this transition shifts to lower energy with increasing substitution at the double bond. However, in the case of conjugation, the pi-orbitals are split and the absorption spectra correspondingly altered. The ionization potentials of the same olefins were measured by photoionization techniques. A decrease of ionization potential with increasing molecular size is found; this phenomenon correlates on the basis of hyperconjugation of the groups attached to the double bond. The photoionization yield of a molecule is found to depend on its relative stability, with both photoionization and photodissociation competing for the absorbed energy. Author

N70-37783# Eidgenossische Technische Hochschule, Zurich (Switzerland).
SILICON CONTAINING CARBONIC ACIDS AND DERIVATIVE COLORS AND SYNTHETIC FIBERS [SILICIUMHALTIGE CARBONSAEUREN UND DAVON ABGELEITETE FARBSTOFFE UND KUNSTSTOFFE]
Pasquale Gallegra (Ph.D. Thesis) 1969 145 p refs In GERMAN
(Diss-Nr-4286) Avail: CFSTI

Produced were a number of silicon alkyl groups containing mono- and dicorbonic acids and their derivatives for the synthesis of dyes and polymers. Obtained silylated fluorescein, eosin, rhodamin B, phenolphtalein, and chinophtalon possessed similar dye and fast color properties as non-silylated dyes. Synthetic copper-, cobalt-, and metal-free phthalocyanines provided fast color laquers. Six of 24 new acyl amino anthrachinon dyes developed from acid chlorides contained in trimethyl silyl groups indicated good to excellent fast color properties. Potassium permanganate oxydation of silicon

containing aromatic hydrocarbons produced five new aromatic dicorbonic acids. Diisocyanate reduction by the Curtius method produced corresponding acid azides which in turn give silicon containing polyurethanes after polyaddition of various dioles. These opaque polyurethanes were hard and exhibited a high melting point. Transl. by G.G.

N70-37784# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE QUESTION OF EXISTENCE OF INTRAMOLECULAR ENDOCYCLIC NUCLEOPHILE SUBSTITUTION REACTIONS ON TETRAHEDRAL CARBON [ZUR FRAGE DER EXISTENZ INTRAMOLEKULARER ENDOCYLISCHER SN-REAKTIONEN AM TETRAHEDRALEN KOHLENSTOFF]
Leander Tenud (Ph.D. Thesis) 1969 108 p refs In GERMAN
(Diss-Nr-4331) Avail: CFSTI

Two models are used to demonstrate the possibility of intramolecular endocyclic nucleophil substitution reactions. Cross over experiments proved a base induced alkylation change of benzyl (o-methoxy sulfonyl) p-tolylsulfon to alpha phenyl ethyl (o-sulfonyl oxy) p-tolylsulfon salts. Nuclear spectroscopy established kinetic changes in the analog alkylation change of o-methoxy sulfonyl thioanisol to o-dimethyl sulfonium benzol sulfonate. Results depict a bimolecular reaction sequence. Transl. by G.G.

N70-37901 Polytechnic Inst. of Brooklyn, N.Y.
ULTRASONIC EXTRACTION FROM CAPILLARY TUBING
Donald Peter Sandholm (Ph.D. Thesis) 1969 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-17799

Methanol, the solvent, was contained in a square cross section extraction cell. The ultrasonic waves were supplied by a transducer attached to the bottom of the tank of stearic acid. The sound frequency used was 21.5 kHz with a power range of 15.6 to 64.4 watts measured calorimetrically. A photographic method was used to analyze the extraction from the Teflon capillary tubes, whose diameters ranged from 0.1330 inch to 0.0150 inch. Extraction runs were made at 75 F and 87 F. The depth of extraction, E, versus time, t, data can be represented by the equation, E = At to the Bth power, where A (called the intercept value) and B (called the slope value) are functions of tubing diameter, ultrasonic power and temperature. Correlations were developed which express the effect of variation of these parameters. Dissert. Abstr.

N70-37973# Stanford Research Inst., Menlo Park, Calif.
SENSITIVITY FUNDAMENTALS Final Report, 15 Mar. 1962 - 28 Feb. 1970
Marion E. Hill, David S. Rose, Robert Shaw, Robert W. Woolfolk, and Theodore Mill 15 May 1970 93 p refs
(Contract Nonr-3760(00))
(AD-706750) Avail: CFSTI CSCL 7/4

The report summarizes the results of a program of basic research into the relationship between detonation phenomena and chemical structure and kinetics for difluoraminoalkanes. The objective of this study was to define the minimum number of chemical and physical parameters of the system needed to predict detonation sensitivity. This research program was carried out in three areas: High-velocity detonation phenomena, including gap tests for smooth shock reaction times, failure diameters, and shock temperature calculations; Low-velocity detonation, not previously recognized for this class of compounds and a phenomenon that adds a new dimension to the handling hazards of difluoraminoalkanes; and Kinetics of homogeneous gas-phase decomposition and catalyzed elimination of HF in the liquid phase. The conclusion section emphasizes the special relationships that were established in the earlier sections between sensitivity measurements, thermochemistry, kinetics, and physics of the compounds examined. Author (TAB)

N70-38001# Naval Ordnance Lab., White Oak, Md.
REPORT ON TRIP TO RESEARCH LABORATORIES IN THE UNITED KINGDOM, 2-25 APRIL, 1968
Gordon Atkinson 26 Mar. 1970 17 p
(AD-706704; NOLTR-69-202) Avail: CFSTI CSCL 7/4

A trip was taken to the United Kingdom to inspect the state of electrochemical research. Visits were made to university, industrial, and government laboratories doing research pertinent to NOL tasks. Particular emphasis is placed on the research effort in fluidized bed electrodes taking place at Newcastle and Southampton Universities. Author (TAB)

N70-38021# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROPHOTOMETRIC ANALYSIS OF ALLOYS
I. P. Kharlamov 8 Apr. 1970 238 p refs Transl. into ENGLISH from Spektrofot Spektrofotometricheskii Analiz Splavov (Moscow) 1969 p 1-208
(AD-707115; FTD-MT-24-458-69) Avail: CFSTI CSCL 7/4

The book presents theoretical principles of the spectrophotometric analysis method; given is the description of Soviet equipment and procedures. Given are absorption spectra of basic solutions and solvents used in analytical chemistry, absorption spectra of solutions of complex metal compounds. Given is also an evaluation of possibilities of the spectrophotometric method in determination of metals by the magnitude of light absorption of their colorless or slightly-colored ions. Presented are detailed methods for determination of certain metals in various types of metallurgical products; without the use of any special reagents, they considerably reduce labor consumption and cost of analyses. Author (TAB)

N70-38027# Naval Research Lab., Washington, D.C. Surface Chemistry Branch.
EVIDENCE THAT POLYWATER IS A COLLOIDAL SILICATE SOL Interim Report
Willard D. Bascom, Edward J. Brooks, and Bradford N. Worthington, III 21 Apr. 1970 15 p refs
(AD-706326; NRL-7115) Avail: CFSTI CSCL 7/4

A study was made of the anomalous condensation of water and its conversion to polywater in glass and silica capillaries. The condensate was expelled as a sol-like material that on evaporation frequently gave a particulate appearance. The residue was analyzed using the electron probe and found to contain significant amounts of silicon and sodium. These results suggest that the unusual properties of polywater may be due to the presence of silica or silicate. It is further shown that, since alkaline silicate solutions can absorb CO2, the infrared spectra of polywater may actually be due, in part, to bicarbonate ion. Author (TAB)

N70-38070# Massachusetts Inst. of Tech., Cambridge, Mass. Dept. of Chemistry.
ENERGY TRANSFER PROCESSES IN MONOCHROMATICALLY EXCITED IODINE MOLECULES. 3: QUENCHING AND MULTIQUANTUM TRANSFER FROM v' = 43
R. B. Kurzel and J. I. Steinfeld 1970 48 p refs Supported in part by NSF and Am. Chem. Soc.
Avail: Issuing Activity

The fluorescence arising from absorption of the 5145 A laser line by molecular iodine vapor was analysed. Quenching and vibrational and rotational energy transfer efficiencies for collision between the excited iodine and other gases were determined, using a numerical solution of the master equation for relaxation. Vibrationally inelastic processes with Delta v' ranging from +5 to -8 were observed; their relative magnitudes appear to be well predicted from the oscillator matrix elements of the intermolecular potential coupling terms, properly weighted by a detailed-balancing factor. Author

N70-38149# Monsanto Research Corp., Dayton, Ohio.
MOLECULAR STRUCTURE AND MATERIALS CHARACTERIZATION Annual Summary Report, 1 Mar. - 31 Dec. 1969
William R. Feairheller Mar. 1970 44 p refs
(Contract F33615-67-C-1363)
(AD-706372; MRC-DA-235; AFML-TR-70-25) Avail: CFSTI CSCL 7/4

Brief discussions are given on research on the following topics: The far infrared spectra of inorganic compounds; The infrared spectra of amino acids and simple polypeptides; Basic concepts for infrared spectroscopic analysis; Infrared study of methyl esters; Studies on cesium iodide cell materials; Spectral presentation format; Spectra and structure of halogenated organic acids; and Spectroscopic investigation of halogen-containing materials involving group V species. TAB

N70-38191*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TURBIDIMETRIC DETERMINATION OF SULFITE ION IN INHIBITED ETHYLENE GLYCOL-WATER SOLUTIONS
Helein D. Bullard, Lee D. Underhill, and George L. Baughman 18 Sep. 1970 17 p refs
(NASA-TM-X-65135; KSC-TR-1073) Avail: CFSTI CSCL 07D

Hydrochloric acid and potassium iodide are added to the glycol-water solution which is then titrated with potassium iodate solution to a turbidimetric end point provided by the oxidation of the 2-mercapto benzothia-zole inhibitor. The instrumental method using a colorimeter to detect the turbidimetric end point has a standard deviation of about 0.2 in the 0 to 20 microgram Na2SO3 per ml concentration range. Author

N70-38192*# Peninsular Chemresearch, Inc., Gainesville, Fla.
PREPARATION OF FLUOROELASTOMERS FOR USE WITH CRYOGENIC STORABLE PROPELLANTS Final Report, 1 Feb. 1968 - 31 Jan. 1969
Eugene C. Stump and Stephen E. Rochow 31 Jan. 1969 42 p refs
(Contract NAS7-668)
(NASA-CR-112965) Avail: CFSTI CSCL 21I

The preparation and polymerization of tetrafluoro ethylene oxide (TFEO) was investigated. Carboxy-terminated polyperfluoroethers were extended and cross-linked with chromium trifluoro acetate and dicyclo pentadiene dioxide. Initial attempts to prepare an acid fluoride-terminated prepolymer by reaction of TFEO and perfluoro glutaryl fluoride were unsuccessful. Hexafluoro propylene oxide could not be prepared using glow discharge and ultraviolet irradiation techniques. Author

N70-38211# Defense Documentation Center, Alexandria, Va.
NUCLEAR MAGNETIC RESONANCE. VOLUME 1: A DDC BIBLIOGRAPHY, JANUARY 1966 - NOVEMBER 1969
Mar. 1970 345 p refs
(AD-703400; DDC-TAS-70-18-1-Vol-1) Avail: CFSTI CSCL 7/4

The volume is a compilation of annotated references on nuclear magnetic resonance dealing mainly in chemical shifts and their identification. A few references on theoretical discussions of nmr spectroscopy are included. Author (TAB)

N70-38223# Kentucky Univ., Lexington. Dept. of Chemistry.
ABSORPTION AT ELECTRODES: ISOTHERM PARAMETERS FOR ALKYL ALCOHOLS IN VARIOUS ELECTROLYTES
A. Karim Shallal, Henry H. Bauer, and Dieter Britz Apr. 1970 27 p refs
(Contract DAAB07-68-C-0366; Proj. Themis)
(AD-706230; THEMIS-UK-RR-11) Avail: CFSTI CSCL 7/4

Frumkin-isotherm parameters are reported for 1-butanol, 1-pentanol, and cyclohexanol, in solutions containing 0.05, 0.1, or 1 M concentrations of KF, KCl, NaClO4, or Na2SO4, over a range of potentials. The nature and concentration of the electrolyte, as well as the potential, influence the magnitudes of the interaction parameter and of the adsorption coefficient. These effects are in qualitative accord with known facts about the adsorbabilities of the alcohols and electrolytes. The Frumkin isotherm describes the data well, except in the presence of fairly strongly specifically adsorbed anions. Author (TAB)

N70-38296# United Kingdom Atomic Energy Authority, Wantage (England). Isotope Research Div.
SOME METHODS OF ELIMINATING MATRIX EFFECTS DUE TO A SINGLE INTERFERING ELEMENT IN RADIOISOTOPE X-RAY FLUORESCENCE SPECTROMETRY
B. Dziunikowski (Ints. Tech. Jadrowe, Krakow, Poland) Jan. 1970 18 p refs
(AERE-R-6247) Avail: AEC Depository Libraries; HMSO 13s BIS $0.60

Three methods of overcoming matrix effects in radioisotope X-ray fluroescence are suggested based on measurements with one, two, or three elemental filters. Examples illustrating the measurement of the concentration of copper in copper ores when iron is present as the interfering element are given, but the methods can also be extended to any other material in which there is only one interfering element. Application of the suggested methods can considerably improve the accuracy of certain measurements and the choice of the method depends on the particular problem, expecially on the range of concentration of the wanted and interfering elements. Author (NSA)

N70-38308# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Hautes Pressions.
FAR ULTRAVIOLET ABSORPTION SPECTRA OF MOLECULES TRAPPED IN A RARE GAS MATRIX AT LOW TEMPERATURE Final Technical Report, 1 Apr. 1969 - 31 Mar. 1970
B. Vodar, N. Damany, J. Poncin, and E. Boursey Apr. 1970 33 p refs
(Contract DAJA37-69-C-0758)
(AD-706847; ARDG(E)-E-1407) Avail: CFSTI CSCL 7/4

A new type of double-beam monochromator has been built for studying below 1050 A, electronic transitions of solid N2 and solid Ne around 800 A and searching for Rydberg transitions of various molecules. Results are also given about the classical photographic study of trapped O2, NH3,Ph3 and P in the Schumann region. Author (TAB)

N70-38311# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THERMODYNAMIC AND KINETIC STUDIES ON MIXED COMPOUNDS OF RARE EARTHS [THERMODYNAMISCHE UND KINETISCHE UNTERSUCHUNGEN VON MISCHKOMPLEXEN DER SELTENEN ERDEN]
Urs Karlen (Ph.D. Thesis) 1969 102 p refs In GERMAN
(Diss-4351) Avail: CFSTI

Stability constants for mixed compounds of lanthanum(n) ethylene diamine tetraacetate with chelate ligands 8-oxychinoline 5-sulfonate, imino diacetate, and nitrilo triacetate were determined by pH measurements; temperature profiles were measured by calorimeter. Obtained stability constants were used to calculate thermodynamic properties and reaction entropies. Comparison of observed thermodynamic data with those from similar mixed compounds of lanthanum(3) aquaions show that coordination values for all lanthanide aquoions remained stable but changed in lanthanide(n) mixed complexes by one unit during transfer from samarium to europium to gadolinium to terbium. Transl. by G.G.

N70-38332# Eidgenossische Technische Hochschule, Zurich (Switzerland).
A NEW VERSION OF THE EPOXY KETONE TO ALKINON FRAGMENTATION: THERMAL DISSOCIATION OF HYDRAZONES FROM alpha beta-EPOXY CARBONYL COMPOUNDS AND N-AMINO AZIRIDINES [EINE NEUE VERSION DER EPOXYKETON ZUR ALKINON-FRAGMENTIERUNG: THERMISCHER ZERFALL DER HYDRAZONE AUS alpha beta-EPOXYCARBONYL-VERBINDUNGEN UND N-AMINO-AZIRIDINEN]
Ulrich Horn (Ph.D. Thesis) 1969 95 p refs In GERMAN
(Diss-4372) Avail: CFSTI

Thermal fragmentation of hydrazones, developed from alpha, beta-epoxy carbonyl compounds and N-amino aziridines, produced molecular nitrogen, an olefine, an alkinyl, and a carbonyl fragment. Comparison of this fragmentation method with results from alpha, beta-epoxy carbonyl compound fragmentations with p-toluol sulfonyl hydrazine established the advantages and application possibilities of the new method. Transl. by G.G.

N70-38343# Virginia Univ., Charlottesville. Dept. of Chemistry.
ORGANIC REACTIONS IN FUSED SALTS Final Report, 1 Aug. 1965 - 31 May 1970
Thomas I. Crowell 31 May 1970 4 p refs
(Grants DA-ARO(D)-31-124-G-725; DA-ARO(D)-31-124-G-823)
(AD-706912; AROD-4290-6-C) Avail: CFSTI CSCL 7/3

A very brief review is given of research conducted to measure a reaction rate in dilute aqueous solution and increase the electrolyte concentration until the anhydrous molten salt was reached. An other investigation dealt with reaction in aqueous thiocyanate solutions. Author (TAB)

N70-38352# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Film Dept.
SOLUTION PROPERTIES OF VINYLIDENE CHLORIDE-ACRYLONITRILE COPOLYMERS
M. L. Wallach [1969] 7 p refs
Avail: CFSTI

The samples studied were polymers of VC12-AN of composition 91 per cent weight VC12, 9 per cent weight AN. Two whole polymers were characterized prior to fractionation; the weight average molecular weights obtained are given. Samples of each whole polymer were then fractionally precipitated using the solvent/nonsolvent system tetrahydrofuran/m-heptane. The fractions were further purified by reprecipitation and were characterized for weight and number average molecular weight and intrinsic viscosity. Molecular weight distribution curves were constructed; the distribution was found to be skewed to the low molecular weight side. Mark-houwink relations were obtained, and unperturbed chain dimensions were derived from the viscosity-molecular weight data. The results are discussed and presented in tabular form. P.A.B.

N70-38384# Westinghouse Research Labs., Pittsburgh, Pa.
LABORATORY STUDIES OF ATOMIC COLLISION PROCESSES IN ATMOSPHERIC GASES Final Report, 24 Apr. 1969 - 3 May 1970
A. V. Phelps and J. L. Pack 15 May 1970 44 p refs
(Contract DAHC04-69-C-0053)
(AD-706922; AROD-8406-1-P; Rept-70-9C8-COGAS-R2) Avail: CFSTI CSCL 7/4

A combination drift tube and quadrupole mass spectrometer has been modified so as to make possible measurements of the rate coefficients for the hydration of atmospheric negative ions at low partial pressures of water vapor in oxygen. The partial pressure of the water is determined from measurements of the rate of production of positive ions produced by electron ionization of the gas effusing from the orifice between the drift tube and the mass spectrometer. Preliminary results obtained during this contract include calibration of the ionizer and measurement for the rate constant for the reaction O2(-) + 2O2 yields O4(-) + O2 and its inverse. Author (TAB)

N70-38386# Oregon Univ., Eugene. Dept. of Physics.
PREPARATION OF CRYSTALS OF ALKALINE EARTH OXIDES AND RELATED COMPOUNDS Final Report, 1 Jun. 1968 - 31 Jan. 1970
J. C. Kemp (Oregon Univ., Eugene), W. P. Fredericks, W. A. Propp, and R. Tanner 31 Jan. 1970 44 p refs Prepared in cooperation with Oregon State Univ.
(Grant AF-AFOSR-1609-68)
(AD-706924; AFOSR-70-0445TR) Avail: CFSTI CSCL 20/2

Processes developed during the period of the project for the purification of BaO, SrO, and CaO are described. These involve, with some variations, dissolution, precipitation of heavy metals and transition metals with (NH4)2S, filtration upon a millipore filter, recrystallization of the alkaline earth nitrates from HNO3 solution, precipitation of the carbonates with CO2 and thermal decomposition to the oxides. Analysis by atomic absorption spectrometry and nuclear activation analysis demonstrates that, except for the presence of other alkaline earths, the purity of the starting material for crystal growth is markedly improved by this treatment. Apparatus for crystal growth from the molten oxides, by the Czochralski method, and from oxide powders by the Verneuil method using a plasma torch, has been constructed. By means of a double-resonance method in which the magnitude of the magnetic circular dichroism is changed by simultaneous ESR excitation, the 4.3 eV optical absorption band in MgO has been definitely shown to be due to Fe(3+). Author (TAB)

N70-38387# Bowdoin Coll., Brunswick, Maine.
A SPECTROSCOPIC STUDY OF FERROCENE AND RELATED COMPOUNDS Final Report, Jan. - Nov. 1969
Ivan J. Hyams Wright-Patterson AFB, Ohio AFML Mar. 1970 63 p refs
(Contract F33615-69-C-1247)
(AD-706925; AFML-TR-69-321) Avail: CFSTI CSCL 7/4

The work discussed in the report is involved with an attempt to explain discrepancies between an earlier vibrational assignment and recent studies of ferrocene, and its derivatives. Low temperature infrared and Raman work has been carried out showing some new and interesting features. The Raman study of a single crystal of ferrocene showed useful polarization features and is used to compare and contrast the original assignment with its alternatives. The infrared spectrum of the solid shows definite evidence for a breakdown in the selection rules. Factor group splitting is of the order of 2/cm. Force field calculations and the preparation and spectra of any related compounds considered to be appropriate are also discussed herein. Author (TAB)

N70-38394# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
TUNGSTEN BRONZE RELATED NON-NOBLE ELECTROCATALYSTS Final Report, 20 Apr. - 20 Oct. 1969
J. O'M. Bockris, R. A. Fredlein, and A. Damjanovic Fort Monmouth, N.J. ECOM May 1970 37 p refs
(Contract DAAB07-69-C-0077)
(AD-706861; ECOM-0077-F) Avail: CFSTI CSCL 7/2

Sodium tungsten bronzes incorporating a second transition metal (Nb, Ta, V, Co and Zr) were prepared. Techniques of chemical analysis have been developed and some bronzes analyzed. X-Ray diffraction studies show these bronzes to be mixed bronzes in which the second transition metal partly replaces tungsten in the lattice. Oxygen evolution and dissolution were studied on the mixed bronzes and some pure bronzes. pH and oxygen partial pressure dependencies have been obtained. The data are discussed. TAB

N70-38403# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.

COMPILATION OF PHYSICAL DATA FOR THE LIQUID METALS Li, Na, K, Rb, Cs

Juergen Freund Jul. 1969 184 p refs In GERMAN

(TUBIK-13) Avail: AEC Depository Libraries

A compilation of physical data which contains nuclear engineering data and the thermophysical properties of the liquid and vaporous phases of the alkali metals Li, Na, K, Rb, and Cs is presented. The temperature-dependent physical data are represented in diagrams. For each property, the results of various investigators are given to permit comparisons. In addition to the diagrams, the equations proposed for the equalization curves are compiled. Critical data and solubility curves for oxygen and hydrogen are included. Author (NSA)

N70-38443# Gottingen Univ. (West Germany). Inst. fuer Physikalische Chemie.

INVESTIGATIONS OF THE RECOMBINATION OF O ATOMS WITH CO OVER THE LARGEST RANGE OF TEMPERATURE AND PRESSURE PRACTICABLE IN THE SHOCK TUBE, 1. STUDY OF THE THERMAL DISSOCIATION OF HYDROGEN PEROXIDE AT TEMPERATURES ABOVE 1000 K, 2. STUDY OF THE UNIMOLECULAR DISSOCIATION OF FORMALDEHYDE, 3. Final Scientific Report, 1 Mar. 1968 - 28 Feb. 1970

E. Meyer, H. A. Olschewski, H. Gg. Schecker, J. Troe, H. Vasatko et al 31 Mar. 1970 65 p refs

(Contract AF 61(052)-946)

(AD-706898) Avail: CFSTI CSCL 7/4

The recombination reaction CO + O + M yields CO2 + M was studied in incident and reflected shock waves from 1200 K to 2300 K. The recombination rate constant has a slightly negative apparent activation energy and confirms an unusual behaviour of the temperature dependence of the recombination rate constant. The unimolecular dissociation of hydrogen peroxide was investigated near the low pressure limit. Experiments at 20atm indicated the beginning of the fall-off region. In addition, light absorption corresponding to a species which forms and is consumed again during the reaction, was observed around 2300A. This absorption is possibly due to HO2. The thermal dissociation of formaldehyde at low concentrations in argon was investigated at temperatures 1400 < T < 2200 K. It could be shown that consecutive reactions of the unimolecular dissociation were important even at concentrations as low as 0.02 percent. The consequences of the measured rate constant on the values of the dissociation energies D(H-HCO) and D(H-CO) are discussed. Author (TAB)

N70-38444# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIAL FEATURES OF THE INTERACTION OF GRAPHITIZED CARBON MATERIALS WITH GASES IN THE 700 - 2500 TEMPERATURE REGION

I. A. Yavorskii et al 30 Jan. 1970 14 p refs Transl. into ENGLISH from Khim. Tverd. Topl. (Moscow), no. 1, 1969 p 139 - 144

(AD-706182; FTD-HT-23-631-69) Avail: CFSTI CSCL 7/2

New experimental data were presented on the reaction rate of porous graphites and pyrographite with CO2, N2O vapors, and O2, H2 mixture at a temperature up to 2500 degrees centigrade. The purpose of the experiments was to make clear the mechanism of high temperature oxidation of pure carbon materials which are widely used in various branches of new technology. The experimental setup and procedure are described. The spherical or rectangular samples were heated in an argon stream up to a given temperature, then in a stream of unheated oxidizing gas to determine the average oxidation rate constant. The oxidation rate in the experiments with preheated gas was not significantly different from that determined without preheating. The data indicated that oxidation of the porous graphite was diffusion controlled to a considerable extent and that the oxidation of pyrographite was mainly kinetics controlled over the temperature range studied. TAB

N70-38452*# National Aeronautics and Space Administration, Washington, D.C.

DETERMINATION OF CERIUM, GADOLINIUM, DYSPROSIUM, ERBIUM, AND YTTERBIUM

Takuji Komori et al Sep. 1970 16 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 15, 1966 p 589 - 593

(NASA-TT-F-13177) Avail: CFSTI CSCL 07E

Concentration of cerium, gadolinium, dysprosium, erbium, and ytterbium in thorium dioxide were measured by the isotope dilution method, using electromagnetically enriched isotopes (Ce-140, Gd-155, Dy-164, Er-167 and Yb-173) as spike isotopes. After dissolving each sample, a measured quantity of the spike solution was added to it. Rare earth elements were separated from samples by the thiocyanate-tri-n-butyl phosphate extraction and further divided into two groups, La-Eu and Gd-Lu, through reversed-phase chromatography. The isotopic composition of cerium was measured from the first group and that of gadolinium, dysprosium, erbium, and ytterbium from the second group with a surface ionization type mass spectrometer. From the results of these measurements, the concentration of each element was determined. Satisfactory precision and accuracy was obtained in determing cerium, gadolinium, dysprosium, erbium, and ytterbium in the ppm-ppb range of concentration. Author

N70-38465# California Univ., Berkeley

ATOMIC FLUORESCENCE YIELDS Final Report, 28 Sep. 1965 - 1 Mar. 1969

Hans M. Mark 1 Mar. 1969 21 p

(Grants DA-ARO(D)-31-124-G740; DA-ARO(D)-31-124-G913)

(AD-706911; AROD-5993-1-P) Avail: CFSTI CSCL 7/4

Research effort was concentrated to employ high resolution lithium drifted germanium detectors in an effort to obtain high precision measurements of atomic fluorescence yields. This portion of the research was accomplished successfully. Other efforts to investigate ways of using Auger electron spectroscopy to enhance knowledge of atomic fluorescence yields were not achieved. The report describes the research techniques used in the two areas. Author (TAB)

N70-38499# Heidelberg Univ. (West Germany).

NITROGEN-PHOSPHORUS POLYMERS Summary Report, Jul. 1966 - Oct. 1968

Margot Becke-Goehring Mar. 1970 50 p refs

(Contract AF 61(052)-682)

(AD-706129; AFML-TR-64-417-Pt-3) Avail: CFSTI CSCL 7/2

The structure of phosphorus pentachloride has been investigated and reviewed. The two general types of reactions of phosphorus pentachloride, the formation of adducts and substitution reactions are discussed. The reactions of phosphorus pentachloride with ammonia derivatives of the structure R-NH2, ammonia and its salts, hydroxylamine and its salts, hydrazine and its derivatives, phosphoryl amide and thiophosphoryl amide, and monomethyl ammonium chloride are described. Author (TAB)

N70-38512# Wisconsin Univ., Madison. Dept. of Chemistry.

THE 1-SILYL DERIVATIVES OF PENTABORANE (9)

Donald F. Gaines and Terry V. Iorns Jun. 1970 10 p refs Submitted for publication

(Contract N00014-67-A-0128-0008)

(AD-707436; TR-2) Avail: CFSTI CSCL 7/2

It was found that gas phase thermolysis of mu-(CH3)3SiB5H8 at about 80C results in irreversible formation of 2-(CH3)3SiB5H8

at a reasonable rate. At higher temperatures further isomerization occurs to produce 1-(CH3)3SiB5H8. This isomerization, however, is reversible and 1-(CH3)3SiB5H8 predominates by a factor of about 3.3 at 120C. Gas phase thermolysis of 2-H3SiB5H8 at 150C results in a similar conversion to 1-H3SiB5H8. This isomerization also appears to be reversible. Author (TAB)

N70-38584# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CONTRIBUTION TO LIQUATIVE SEGREGATION BEHAVIOR IN BINARY SYSTEMS AT ARBITRARY CONCENTRATIONS [BEITRAG ZUM SEIGERUNGSVERHALTEN IN BINAEREN SYSTEMEN BEI BELIEBIGER KONZENTRATION]
Juerg Troxler (Ph.D. Thesis) 1969 70 p refs In GERMAN
(DISS-4264) Avail: CFSTI

Guided solidification of two-component mixed melts of metallic as well as nonmetallic systems is explored to determine the deciding factors. The dependence of the liquation separation coefficient on melt solidification velocity, component concentration in the melt, and solidification direction is found by correlating degrees of impurities in the solid with those of the liquid phase. Considered are phase diagrams that show crystal structures in the mixed melts and developing sedimentation effects which culminate in reversal of the normal separation direction in vertical solidification processes. Transl. by G.G.

N70-38591# California State Coll., Los Angeles. Dept. of Chemistry.
AMINE CHEMISTRY OF 4,5-DICARBA-NIDO-HEXABORANE(8)
J. R. Spielman, J. E. Scott, Jr., and Thomas Onak Jun. 1970 14 p refs Submitted for publication
(Contract Nonr-3364(00))
(AD-707433; TR-27) Avail: CFSTI CSCL 7/2

The amine chemistry of 4,5-dicarba-nido-hexaborane(8), 4,5-C2B4H8, and its C-methyl derivatives has been examined. Both 4,5-C2B4H8 and 4-CH3-4,5-C2B4H7 from adducts with trimethylamine, but 4,5-(CH3)2-4,5-C2B4H6 is relatively inert. 4,5-Dicarbahexaborane(8) and its dimethyl derivative form 1:4 addition compounds with dimethylamine. The adducts decompose on heating to form dimethylaminoborane, bis-dimethylaminoborane and hydrogen. The non-volatile adducts of their thermal decomposition residues form dimethylaminodiborane but very little hydrogen on treatment with diborane. Author (TAB)

N70-38617# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Film Dept.
NOVEL POLYAMIDES FROM MACROCYCLIC ETHERS
W. M. Feigenbaum and R. H. Michel Feb. 1970 11 p ref *Its* Publ. Proposal No. 288
Avail: CFSTI

Dibenzo-18-crown-6 was converted into two isomeric diamines by denitro derivitives, and polyamides were prepared by condensation of diamines with aromatic diacid chlorides. These polymers complex some alkali metal cations but not alkaline earth metal cations. The compounds were prepared to obtain tough polymeric films. E.H.W.

N70-38699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODIFICATION OF POLYACRYLONITRILE FIBER BY GRAFT COPOLYMERIZATION
M. P. Penkova et al 30 Jan. 1970 12 p refs Transl. into ENGLISH from Khim. Volokna (USSR), v. 11, no. 2, 1969 p 18-21
(AD-706187; FTD-HT-23-664-69) Avail: CFSTI CSCL 7/4

The acrylonitrile 4-(beta-vinylsulfonyl)-2-aminoanisole copolymer (I) (PANV) fiber was modified by graft copolymn. with Me acrylate (II), Bu acrylate (III), or acrylic acid (IV) in the presence of a redox system composed of HVO3 plus H2SO4. The graft copolymerization kinetics was markedly affected by fiber orientation. Smaller degree of drawing and higher reaction temp. brought about increased polymn. rate. The grafted copolymers-exhibited higher loop strength, wear resistance, and in the case of I-IV graft copolymer, also increased flexural strength. TAB

N70-38766# Naval Research Lab., Washington, D.C. Fuels Branch.
COMPARISON OF HOPCALITE AND A SUPPORTED HOPCALITE FOR APPLICABILITY TO SUBMARINE USE
F. S. Thomas, J. K. Musick, and J. E. Johnson Apr. 1970 23 p refs
(AD-707335; NRL-MR-2105) Avail: CFSTI CSCL 7/4

In conjunction with a study on criteria for the selection of oxidation catalysts for use in air purification in nuclear submarines, several catalysts have been investigated with regard to suitable physical properties and catalytic activity. In this report the presently used Hopcalite catalyst is compared with a supported Hopcalite catalyst with an alumina base. It was found that the present Hopcalite was clearly superior in almost all aspects of catalytic activity to the supported Hopcalite. Author (TAB)

N70-38788# Bureau of Mines, Amarillo, Tex. Helium Research Center.
TWO-PHASE EQUILIBRIA OF ANALYTICAL BINARY SOLUTIONS NEAR THE CRITICAL POINT
Beverly J. Dalton Sep. 1970 14 p refs
(BM-IC-8486) Avail: Issuing Activity

Several relationships between coexisting phases for analytical binary solutions near the critical point are given. The relationships were developed from a consideration of a (G, u, P) surface at constant temperature and a (G, u, T) surface at constant pressure, where G is the molal Gibbs free energy, u is the concentration of component 1 expressed as a mole fraction, P is the pressure, and T is the temperature. The formulas should facilitate the calculation of some of the quantities useful in making thermodynamic consistency checks on phase equilibria data about the critical point. Author

N70-38859 Louisiana State Univ., New Orleans.
SYNTHETIC AND SPECTRAL STUDIES OF NITRILE COMPLEXES OF RHODIUM(III) AND IRIDIUM (III, IV), PART 1. SYNTHESIS AND PROPERTIES OF METAL CARBAMYLALKYLPHOSPHONATE COMPLEXES, PART 2
Basil Demetriou Catsikis (Ph.D. Thesis) 1969 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-18611

A series of rhodium(III) acetonitrile complexes of the general formula RhXm(CH3CN)n were prepared and characterized by their visible infrared and proton NMR spectra. The complex RhCl4(C6H5CN)2 was also isolated. Electronic and n.m.r. spectra were obtained for the (IrCl5(CH3CN))(−) and the (IrCl3(CH3CN))(+) complex. A comparison between the spectra of the monosubstituted acetonitrile complexes of rhodium(III) and iridium(III) indicated that the latter contained a stronger metal-nitrogen bond. The configurations of the two geometrical isomers of the complex RhCl3(CH3CN)3 and of trans-RhCl3(CH3CH2CN)3 were explained. The visible and far infrared spectra of these rhodium(III) acetonitrile complexes were similar to those exhibited by the analogous rhodium(III) pyridine complexes. Part two contains donar properties of various carbamylphosphonates and carbamyl methyl phosphonates. These ligands formed completely chelated complexes with the metal perchlorates and mixed complexes with the metal chlorides or nitrates. The electronic spectra of the complexes indicated that the ligands were comparable to those of the diphosphonates and diamides. Dissert. Abstr.

N70-38861 Clemson Univ., S.C.
A STUDY OF THE ALKALINE EARTH CHELATES OF OPTICALLY ACTIVE TRANS-1, 2-DIAMINO CYCLOPENTANE TETRAACETIC ACID
Billy Thomas Upchurch (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-19742

It was proposed to synthesize the optically active ligands, d- and l-trans-1,2-diamino cyclopentane tetraacetic acid or d- and l-CPDTA, which would chelate stereospecifically with metal ions to form complexes with enhanced optical activity, and to compare the optical properties with those of complexes of known structure. Optical rotatory dispersion and circular dichroism spectra were obtained for solutions of uncomplexed d-CPDTA and compared with those obtained for the alkaline earth metal, aluminum, zinc, cadmium, and several lanthanide chelates of d-CPDTA. On the basis of the comparisons it is evident that the structure of the magnesium complex is different from the other alkaline earth complexes. The zinc and aluminum complexes give identical spectra. The spectra for calcium and cadmium are almost identical and are similar to those of strontium, barium, and samarium. Dissert. Abstr.

N70-38862 Utah Univ., Salt Lake City.
THERMAL FIELD-FLOW FRACTIONATION OF POLYSTYRENE
Gary Haughton Thompson (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-19656

Field-flow fractionation is defined as a separation method in which a concentration-disturbing lateral field is coupled with non-uniform axial flow to induce differential migration. The components then migrate with a characteristic velocity in individual zones, eventually becoming free of other components. The strength of the field may be varied in such a way that larger molecules are gradually released from the more slowly-flowing wall regions. A thermal gradient was studied for polystyrene fractions in toluene and other organic solvents. The flow channels were round, square, and rectangular in shape. Samples of individual fractions and mixtures were tested. The poor polymer separation found in deeper channels is attributed to convective currents which cause remixing of the polystyrene fractions in the sample. The best separation was attained in the rectilinear channel system, a wide, flat duct. At lower temperatures, lower molecular weight fractions were not retained enough to cause separation. Dissert. Abstr.

N70-38882 Oklahoma Univ., Oklahoma City.
PVT PROPERTIES OF GASES TO 10000 BARS AND 400 C
Stanley Lunsford Robertson (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-18462

Apparatus is described which is capable of quickly yielding large numbers of experimental measurements. The apparatus design is such that there are no contaminants or resilient seals in contact with the gases studied. The piezometer is subjected only to hydrostatic stresses and the volumes can be continuously measured. The results obtained for argon, nitrogen, methane and propene are given. The accuracy obtained is estimated to be about 0.2 percent in gas densities at 10,000 bars and considerably better at lower pressures. Comparisons with extant works and with basic theoretical calculations are given. Dissert. Abstr.

N70-38909 IIT Research Inst., Chicago, Ill.
STUDIES OF THE BRANCHING CHAIN OXIDATIONS OF HYDROGEN AND ACETYLENE
Robert William Lutz (Ph.D. Thesis) 1969 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-18147

Three studies of the induction period behavior of the oxidations of hydrogen and acetylene have been carried out to assess the potential of the high sensitivity end-on technique to provide different kinds of quantitative kinetic information. These studies were carried out behind reflected shock waves in a conventional pressure-driven shock tube. In the first study, the end-on technique was used to study three body recombination reactions. The exponential growth of O-CO blue-continuum emission was monitored during the induction period following shock heating of H2-O2-CO-Ar gas mixtures. In the second study the end-on technique was used to obtain fundamental information on the origins of chemiluminescent emission. The exponential growth constants of OH chemiluminescent emission were measured during the induction period of the H2-O2 reaction. In the third study the end-on technique was employed to study the perturbation of a known combustion system by addition of a second fuel, the purpose being to better understand the mechanism of combustion of the second fuel. Dissert. Abstr.

N70-38921 National Lending Library for Science and Technology, Boston Spa (England).
POLYMERISATION IN FILM FORMATION OF COATINGS BASED ON ACRYLIC MONOMERS [POLIMERIZATSIYA V PROTSESSE PLENKOOBRAZOVANIYA POKRYTII NA OSNOVE MONOMEROV AKRILOVOGO RYADA]
V. G. Plisov Jul. 1970 13 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (USSR), no. 2, 1969 p 87 - 89 (NLL-RTS-5962) Avail: Natl. Lending Library, Boston Spa, Engl.: 24s or 4 NLL photocopy coupons

The radical polymerization of acrylic oligomers and polyester acrylates, which has found extensive use in paints and varnishes is discussed with the oxidation and reduction systems applied in the hardening of polyesters and production of lacquers. Recommended compositions for coatings, inks, and binders are given. It is concluded that the processes of film-formation in coatings can be controlled by acrylic monomers. F.O.S.

N70-38953# Eidgenossische Technische Hochschule, Zurich (Switzerland)
CONTRIBUTION TO THE CHEMISTRY OF NIOBIUM (IV) [BEITRAG ZUR CHEMIE DES Niob(IV)]
Werner Perron (Ph.D. Thesis) 1969 83 p refs In GERMAN (Diss-4370) Avail: CFSTI

Developed was a simple method for preparing new niobium(4) compounds through reduction of niobium pentachloride in acetonitrile as solvent. The redox potential of the system Nb(5) to Nb(4) in acetonitril was measured and observed complexes are shown in table form. Analysis of a dichloro bis acetyl acetonato niobium(4) compound indicated that niobium(4) and acetylaceton in solution form a 1 : 2 complex. X-ray and ESR measurements established that both chlorides in niobium(C5H702)2C12 probably are in cis formation, in the solid as well as solution form. Transl. by G.G.

N70-38954# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CHEMICAL BONDING AND NEPHELAUXETIC EFFECT IN TRANSITION METAL COMPLEXES. DISCUSSION OF OPTICAL SPECTRA AND ERS-DATA OF COPPER(II) COMPLEXES IN SINGLE CRYSTALS [CHEMISCHE BINDUNG UND NEPHELAUXETISCHER EFFEKT IN UEBERGANGS-METALLKOMPLEXEN. DISKUSSION VON OPTISCHEN SPEKTREN UND ESR-DATEN VON Cu (II)-KOMPLEXEN IN EINKRISTALLEN]
John Ammeter (Ph.D. Thesis) 1969 191 p refs In GERMAN (Diss-4338) Avail: CFSTI

Single crystal and liquid states of copper(II) picolinate and copper(II) oxichinolate were evaluated by electron spin resonance methods and electron spectroscopy for their electronic structure and molecular bonds. Measurements were used to determine the structure of the occupied higher orbitals by applying the Hartree - Fock model and its wave functions in analysis. Transl. by G.G.

N70-38956 National Lending Library for Science and Technology, Boston Spa (England).
RECENT DEVELOPMENTS IN THE COUNTER FLOW REGENERATION OF ION EXCHANGERS
G. Wieland 2 Apr. 1970 16 p refs Transl. into ENGLISH from Tech. Ueberwach. (Duesseldorf), v. 10, Feb. 1969 p 40 - 45
(NLL-CE-Trans-5222-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Progress in reducing the quantity of chemicals used in regenerating ion exchange processes in water treatment is reported. Counter-current regeneration, the separation of cation and anion stages, and the excess regenerant chemicals required in practice are examined in an effort to approach more nearly the theoretical requirements. Author

N70-38963 National Lending Library for Science and Technology, Boston Spa (England).
THE INITIATION MECHANISM OF THE REDOX POLYMERIZATION OF ACRYLONITRILE IN THE PRESENCE OF METALS OF VARYING VALENCY
Yu. S. Paikachev et al 24 Jun. 1970 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol. (USSR), no. 6, 1968 p 716 - 720
(NLL-M-9185-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The initiating system for the polymerization of acrylonitrile in aqueous solution was investigated with the salts of sulphurous and pyrosulphurous acids coupled with Cu(2+) and Fe(3+) ions. The dependence of the induction period upon the concentration of the metal of varying valency was derived, and the constant for the decomposition rate of the complex anion was determined. An assumption of the probable mechanism of the initiation of acrylonitrile polymerization by three-component systems is discussed. Author

N70-38965 National Lending Library for Science and Technology, Boston Spa (England).
SYNTHESIS OF GRAFT COPOLYMERS OF CELLULOSE AND POLYACRYLIC ACID
M. Penenzhik et al 24 Jun. 1970 3 p Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 6, 1969 p 70
(NLL-M-9188-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A method is described whereby the synthesizing reaction is carried out in a continuous way, and under optimum conditions the amount of homopolymer does not exceed 10 to 20% of reacted monomer. Application of the described methodology demonstrated that not more than 5% of the cellulose enters into the graft copolymerization reaction. Under prescribed conditions the degree of cellulose polymerization drops, on heating the fabric, by 15%, and, on grafting in a medium of water vapor, by 4.5%. D.L.G.

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-37624# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMAL MISMATCHED FILTER DESIGN FOR RADAR RANGING, DETECTION AND RESOLUTION
Robert J. McAulay and J. Russell Johnson 23 Apr. 1970 71 p refs
(Contract AF 19(628)-5167)
(AD-706397; TN-1970-12; ESD-TR-70-55) Avail: CFSTI CSCL 17/9

In a multiple target environment a radar signal processor often uses weighting filters which are not necessarily matched to the transmitted waveform. In this paper expressions for the mean-square range-estimation error, the detection signal-to-noise (SNR) and the effects of sidelobes are derived in terms of the impulse response of an arbitrary mismatched filter. It is desired to find that impulse response which results in the minimum range estimate variance subject to preassigned constraints on the sidelobes and the detection SNR. This optimization problem is first formulated in state-space in which the optimal control law is sought. Pontryagins maximum principle is used to obtain necessary conditions for the optimum impulse response, from which it is possible to deduce the structure of the optimum filter. Certain mathematical details which detract from the rigor of the time domain formulation are resolved by formulating the problem in the frequency domain and applying Hilbert Space techniques. It is shown that for the problem of detecting the radar target and estimating its range, the optimum filter is a modified transversal equalizer. If only the detection function is to be performed the optimum filter reduces to the transversal equalizer. This establishes the optimality of this important practical device as the solution to the radar detection problem in a multiple target environment. The tap weights and spaces of the delay line as well as certain other parameters upon which the solution depends can be found by solving a non-linear programming problem. Numerical results are given for an interesting class of transmitted waveforms which shows the tradeoffs of the various filter parameters. Author (TAB)

N70-37632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE STABILITY OF FRAME AND LINE SCANNING GENERATORS
P. N. Dimiraki 30 Mar. 1970 11 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 12, no. 5, 1968 p 57 - 59
(AD-706161; FTD-MT-24-339-69) Avail: CFSTI CSCL 9/5

Considered are transistorized pulse generators of field and line scanning that make it possible to form pulses having a small nonlinearity coefficient, high stableness of pulse repetition period and small regeneration time. Author

N70-37663# Iowa State Univ. of Science and Technology, Ames.
ON THE DEFINITION AND OBSERVATION OF A SIGNAL VELOCITY FOR PULSED WAVE PROPAGATION IN A MEDIUM WITH A RESONANCE EXHIBITING COLLISION AND DOPPLER BROADENING
Dennis Benedict Trizna (Ph.D. Thesis) Feb. 1970 155 p refs
(Contract W-7405-eng-82)
(IS-T-373) Avail: CFSTI

A theoretical study is made for the case of weak absorption for a Lorentz profile; various signal velocity definitions are made and compared with those for strong absorption. The techniques of early works are used to define a signal velocity for the case of resonance exhibiting a combination of Lorentz and Doppler line broadening for a strongly attenuated signal. Results are presented for the transition from a pure Lorentz profile to a pure Doppler profile as a function of the ratio of the half-widths of the two shapes. A computer calculation is performed using the derived theory to predict the display of a broad band detection system for the case of a Lorentz profile. The results of an interferometer

experiment are also predicted and presented in graphical form. A similar analysis is made for the case of a narrow band detection system. Experimental results are reported in which an attempt was made to measure the signal velocity in the region of anomalous dispersion of a Lorentz profile for weak absorption, using a microwave resonance of ammonia. Author

N70-37713# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.
RADAR SET AN/PPS( ) (FAILURE FREE DEVELOPMENT PROGRAM) Interim Development Report, 28 Feb. - 28 Mar. 1970
Earl L. Chatterton and Walter Seidman 28 Mar. 1970 30 p
(Contract N00039-70-C-3501)
(AD-706801; ESD-1158-IR-2) Avail: CFSTI CSCL 17/9

The report constitutes the second progress report of Phase II of a program to design, manufacture, and test 20 high reliability versions of the AN/PPS-( ) battlefield surveillance radar. This report covers a period mainly devoted to test and evaluation of breadboard designs. Most of the electronic circuitry schematics are being formalized and Equipment Parts Lists are being generated and undergoing reliability analysis to update the mathematical model. Author (TAB)

N70-37734# Sandia Corp., Albuquerque, N.Mex.
ON THE OPTIMUM INTERCEPTION OF INADVERTENTLY EMANATED SIGNALS
Stanley E. Nykanen Jan. 1970 26 p refs
(SC-RR-70-37) Avail: CFSTI

Optimistic values for the detection probability which can serve as realistic upper bounds to the probability that an undesired observer could detect information-bearing signals by indirect methods are obtained. The generalized signal-to-noise ratio is found to be a function of the transmitted signal, the coupling phenomenon, and the spectral density of the additive noise. Measurements necessary to specify the maximum probability of correct bit detection that an observer can achieve are described in detail. In addition, curves which give the probability that an observer correctly detects an n-bit digital message are presented as functions of the length of the message, n, and the probability of correct bit detection. Author

N70-37740# Naval Postgraduate School, Monterey, Calif.
A MULTI-CHANNEL INTERIOR COMMUNICATION SYSTEM UTILIZING TIME MULTIPLEXING
Carl William Kellem (M.S. Thesis) Dec. 1969 36 p refs
(AD-706723) Avail: CFSTI CSCL 17/2

The development of a multi-channel interior communication system utilizing a single wire as a transmission line was undertaken. The principle of time multiplexing was used incorporating the Pulse Amplitude scheme of modulation. Synchronization was accomplished by continuously transmitting a synchronization pulse from one 'Master' station to all other 'Slave' stations. This system permits mutually exclusive conversations between any stations concurrently. A master station and one slave station were built and tested. Using a 10-k Hz sampling frequency, a frequency response of from 100 Hz to 4.8 k Hz was obtained. By using solid-state devices throughout, the size and weight of each station are minimized. This, in conjunction with the need for only one connecting wire, makes this system ideal for modern aircraft. Author (TAB)

N70-37814 Virginia Polytechnic Inst., Blacksburg.
PHASE-ERROR STATISTICS FOR A SECOND ORDER PHASE-LOCKED LOOP AND DESIGN OF AN OPTIMUM DECISION UNIT FOR SPACE COMMUNICATIONS
Abdel-Wahab Fayez H. Hussein (Ph.D. Thesis) 1969 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-18259

The detection of the command signal in space communication is considered. The transmitted signal is a frequency modulated sinusoidal wave. The modulating signal is the sum of the data signal and the synchronizing signal. The command or data signal is in a binary coded form, while the synchronizing signal is a PN sequence. The signal at the front-end unit of the space vehicle's receiver is not the same as the transmitted signal. This is mainly due to the additive noise which is assumed to be a white Gaussian random process and the doppler shift. The probability of error in the decision is present because of the additive noise and the doppler shift. It is to be noted that the threshold is taken to be one because the a priori probability for the two possible choices are equal. Thus, we see that the phase-error probability distribution plays a very important role in the design of the optimal receiver for detection of the data signals in space communication systems. Dissert. Abstr.

N70-37815 Missouri Univ., Rolla.
IMPROVEMENT IN TARGET DETECTION WITH A FREQUENCY AGILE PULSED NON-COHERENT RADAR
Kenneth Lee Horn (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order 69-19428

The target model is modified by assuming time decorrelation and partial correlation of the returns. It is shown that random selection of the transmitted frequency from a continuous probability density function yields a significant reduction in the transmitter bandwidth requirement, when compared to previous analyses, with a negligible decrease in detection range. Two practical density functions for the transmitted frequency are studied in detail, the uniform and anti-sine distribution. However, the results are general in that the curves for detection probabilities may be applied directly to any pulsed non-coherent frequency agile radar whose transmitted frequency is obtained from a probability density function. The analysis yields a closed form solution, previously unknown, for detection probabilities in the case of Swerling's Case I target. A computer program is included which calculates detection probabilities for Swerling's Case I target modified by a time decorrelation function. Dissert. Abstr.

N70-37863# Army Electronics Command, Fort Monmouth, N.J.
VHF-FM DATA AND MULTIPATH DISTORTION PARAMETERS
Thomas M. Seiler Apr. 1970 16 p refs
(AD-706825; ECOM-3252) Avail: CFSTI CSCL 17/2.1

A discussion of the critical parameters causing distortion due to multipath in a VHF-FM data link is presented. Such parameters as time delay, relative amplitude between signals, index of modulation, and modulating frequency are discussed. The effect of varying each of these parameters is demonstrated and bounds on each parameter are established. Some analytical arguments are presented to give an insight into the multipath mechanism. Author (TAB)

N70-37872# Lowell Technological Inst. Research Foundation, Mass.
D-REGION AERONOMICAL CHANGES DEDUCED FROM STEEP INCIDENCE SUNRISE VLF PROPAGATION DATA
Daniel P. Hayes and Gary S. Sales (AFCRL) 1970 12 p refs
Presented at the 3d Conf. on Meteorol. and Chem. Factors in D-Reg. Aeronomy, Chicago, 23 Sep. 1968
(Contract F-19628-68-C-0259)
(AD-706635) Avail: CFSTI CSCL 4/1

Some 12 months of near vertical incidence, mid-latitude VLF data, spanning the period April 1965 through June 1966, have been reduced and analyzed. Analysis of seasonal variations in sky wave amplitude prior to ground sunrise is presented here.

These amplitude changes are accounted for in terms of D-region aeronomy variations. It is shown that early morning changes in Lyman-alpha radiation, nitric oxide and atomic oxygen can explain these preground sunrise amplitude effects. Author (TAB)

N70-37891# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
INTERFERENCE PREDICTION GUIDELINES FOR VHF NON-TACTICAL FM COMMUNICATIONS
G. Morgan May 1970 48 p refs
(Contract F19628-69-C-0073)
(AD-707492; ESD-TR-70-13023) Avail: CFSTI CSCL 17/2.1

The report presents guidelines which may be used for the prediction of interference effects between collocated VHF non-tactical FM equipments. Pertinent technical characteristics and interference susceptibility levels representative of this type of equipment are included. The interference mechanisms discussed include cochannel and adjacent channel effects and non-linear interactions due to spurious receiver responses, and transmitter and receiver intermodulation interference. Sample problems are set forth and solved to illustrate the step by step procedure for prediction of each type of interference phenomenon considered, and the equipment modifications required to prevent degradation. Author (TAB)

N70-37898# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
G. I. Byalik et al 2 Feb. 1970 29 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR); v. 12, no. 2, 1968 p 42 - 46, 55 - 60
(AD-706158; FTD-MT-24-337-69) Avail: CFSTI CSCL 17/2

Contents: Experimental investigation of a system of automatic focusing of television cameras; and Television installation with two-dimensional aperture correction. TAB

N70-37917# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
AN/PPS-( ) ULTRA RELIABLE RADAR Interim Development Report, 3 31 Mar. 1970
6 Apr. 1970 104 p refs
(Contract N00039-70-C-3502)
(AD-706691) Avail: CFSTI CSCL 17/9

The program covers the study, design, construction, test, analysis and inspection of a complete and operative, highly reliable, relatively failure-free version of the pulsed doppler surveillance AN/PPS-6 radar set. The radar set is intended to be a lightweight, miniaturized, X-Band, pulsed doppler combat surveillance radar. The basic purpose of this program is to develop a highly reliable radar set considering the overall cost of ownership when development, production and maintenance costs are taken into account while keeping the same general performance, form-factor and weight as the AN/PPS-6 radar. Author (TAB)

N70-37918# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
AN/PPS-( ) ULTRA RELIABLE RADAR Interim Development Report, 1 - 30 Apr. 1970
J. D. Frattura 8 May 1970 42 p refs
(Contract N00039-70-C-3502)
(AD-706692) Avail: CFSTI CSCL 17/9

For Abstract see N70-37917.

N70-37959*# Technology for Communications International, Mountain View, Calif.
THEORETICAL ANALYSIS OF DIPOLE ANTENNA CHARACTERISTICS ON THE RAE SATELLITE, PART 1 Final Report
Aug. 1970 226 p
(Contract NAS5-11256)
(NASA-CR-113112; TCI-2236-Pt-1) Avail: CFSTI CSCL 09E

Calculations of the expected radiation characteristics of the dipole antenna are presented. The principal other elements affecting the performance of the dipole are a pair of much longer V-antennas and a libration damper. The wire antenna scattering program (WIRA) used in performing the calculations represents the antenna as an assemblage of straight wire segments. Balanced and unbalanced modes, current distribution, dipole input impedance, gain and efficiency, and the dipole alone are discussed. An orthogonal dipole configuration is considered. Preamplifier imbalance is analyzed with regard to receiver response, impedance imbalance effects, and gain imbalance effects. Reproductions of WIRA program printouts are included in the paaendices, indicating the current distributions and radiation patterns for a dipole in the presence of V-antennas and libration damper, for the dipole alone on the satellite, and for orthogonal dipoles. P.A.B.

N70-38053# Naval Postgraduate School, Monterey, Calif.
THE SYNTHESIS OF AN MTI CANCELLATION FILTER USING CAPACITIVE STORAGE ELEMENTS IN THE DELAY LINE
Robert Lee Peterson (M.S. Thesis) Jun. 1969 68 p refs
(AD-706734) Avail: CFSTI CSCL 7/9

By using a series of diode sampling gates and capacitive storage elements to achieve the necessary time delay, a cancellation filter is designed that will give a maximally flat passband and that will give subclutter rejection at zero frequency and at harmonics of the pulse repetition frequency. Such a filter is necessary in each range channel of moving target indication (MTI) radar systems. Theoretical results obtained from digital simulation are compared with actual results obtained upon completion of the filter synthesis, and a brief evaluation of the entire range channel is presented. Author (TAB)

N70-38062# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
OPTIMAL SPATIAL MODULATION FOR RECIPROCAL CHANNELS
Jeffrey H. Shapiro 30 Apr. 1970 130 p refs
(Contract DA-28-043-AMC-02536(E))
(AD-706293; TR-476) Avail: CFSTI CSCL 17/2

The purpose of this research is to find ways of improving optical communication through atmospheric turbulence by using spatial modulation. The performance of a class of adaptive spatially modulated communication systems, in which the antenna pattern at the transmitter is modified in accordance with the knowledge of the channel state obtained from a beacon signal transmitted from the receiving terminal to the transmitter, is examined. For time-invariant channels satisfying a certain reciprocity condition, there exists an adaptive system that achieves the maximum energy transfer possible from transmitter to receiver. This result is applied to the turbulent atmospheric channel by regarding the atmosphere as undergoing a succession of fixed states, and proving that instantaneously the atmosphere is reciprocal. The performance of adaptive spatially modulated systems for the turbulent channel is derived for both point-to-point and deep-space applications. In the deep-space case we find that the turbulence does not increase the average far-field beamwidth attainable with a given diameter aperture, but fluctuations about this average beamwidth do occur as the state of the atmosphere changes. The effects of noise and approximate transmitter implementations on the performance of the adaptive systems under discussion are considered. A hypothetical deep-space system is specified and its performance is evaluated. Author (TAB)

N70-38064# Ohio State Univ., Columbus. ElectroScience Lab.
ASYMPTOTIC HIGH FREQUENCY METHODS Final Report, 1 Apr. 1966 30 Jun. 1969
1 Apr. 1970 20 p refs
(Contract AF 19(628)-5929)
(AD-706110; ESL-2183-6; AFCRL-69-0370) Avail: CFSTI CSCL 20/14

The purpose of the research carried out under this contract was to study the diffraction of high frequency electromagnetic waves by perfectly-conducting bodies. The geometrical theory of diffraction and its application to antenna and scattering problems were of primary interest. It was desired to obtain new diffraction coefficients and to improve the applicability and accuracy of existing diffraction coefficients in the case of electromagnetic diffraction. The research accomplished under this contract is described in the following sections. Author (TAB)

N70-38065# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC DIFFRACTION BY A PERFECTLY-CONDUCTING PLANE ANGULAR SECTION
Ramon S. Satterwhite and Robert G. Kouyoumjian 23 Mar. 1970 198 p refs
(Contract AF 19(628)-5929)
(AD-706111; ESL-TR-2183-2; AFCRL-69-0401; SR-2) Avail: CFSTI CSCL 20/14

The exact solution for the electromagnetic field diffracted by a perfectly conducting plane angular sector is determined. The problem is a three-dimensional vector problem and the solution is presented in the form of a dyadic Greens function, which is the most general form of solution possible. Thus the vector fields as well as the current on the sector may be determined for any given source excitation. Author (TAB)

N70-38138# Atlantic Research Corp., Alexandria, Va. Jansky and Bailey Engineering Dept.
TROPICAL PROPAGATION RESEARCH, VOLUME 2 Final Report
John J. Hicks, A. Page Murphy, E. L. Patrick, and L. G. Sturgill Nov. 1969 244 p refs
(Contract DA-36-039-SC-90889; ARPA Order 371)
(AD-706232) Avail: CFSTI CSCL 17/2.1

The Report Volume II is sequential to Final Report Volume I, which covered an extensive series of radio propagation measurements in a wet-dry (monsoon) tropical jungle in Central Thailand. In contrast, Volume II presents results of measurements in a tropical rain forest area in Southern Thailand. Radio path loss measurements have been conducted in the rain forest area at frequencies from 2 to 400 MHz, for antenna heights above ground from 7 to 120 feet, with both vertically and horizontally polarized transmitting antennas, and at a large variety of path ranges and configurations in the jungle vegetation. Also, this report includes results from jungle-to-air measurements at frequencies of 25, 50, 100, 250 and 400 MHz, generally with aircraft altitudes of about 500 feet. The results from a series of ground-to-ground measurements for paths of mixed proportions of forest and clearing are presented, along with a theoretical model for this type of propagation path. Finally, an attempt is made to summarize the general conclusions which can be drawn from the work thus far, and which may be useful to a wide variety of communications problems in tropical jungle environments. Author (TAB)

N70-38172# Army Missile Command, Redstone Arsenal, Ala. Research and Engineering Directorate Provisional.
ERRORS IN RANGE ESTIMATION BY TRIANGULATION
Nels A. Broste 22 Jan. 1970 22 p
(AD-706227; RE-TR-70-3) Avail: CFSTI CSCL 16/2

The report discusses the estimation of range to target when range information is unavailable; triangulation methods are used which require two angle measuring radars. Two separate means of estimation are presented: the differential analysis approach and the incremental analysis. Author (TAB)

N70-38193 Purdue Univ., Lafayette, Ind.
AN EXPERIMENTAL RANDOM SIGNAL RADAR SYSTEM
William Beggs Waltman (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-17288

An experimental high resolution radar system is described which uses pulsed random noise as the transmitted signal. A sampled digital correlator is used to measure the target range and doppler shift. A model of the random signal radar is presented and analyzed to give the basic equations describing the operation of the system. The sampled analog, hybrid, and polarity coincidence correlators are considered and their characteristics are compared. The performance capabilities of the random signal radar are compared to those of a conventional pulse radar. It is shown that the equations describing the range resolution, doppler resolution, and output signal-to-noise ratio are very similar for the pulse and random signal radars. However, the freedom from range ambiguities of the random signal radar permits the use of sampling rates much higher than the repetition rate of a pulse radar giving unambiguous range information. The effects of the sampling gate width and sampler amplitude errors on the random signal radar performance are considered and results are given. Dissert. Abstr.

N70-38200* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA SYSTEM USING PARASITIC ELEMENTS AND TWO DRIVEN ELEMENTS AT 90 deg ANGLE FED 180 deg OUT OF PHASE Patent
Roland R. Ford, inventor (to NASA) Issued 5 May 1964 (Filed 12 Jul. 1962) 6 p Cl. 343-705
(NASA-Case-XLA-00414; US-Patent-3,132,342; US-Patent-Appl-SN-209478) Avail: US Patent Office CSCL 09E

An antenna system with improved omnidirectional radiation characteristics for use on satellites is described. Four monopole elements, each of which is approximately 1/4 wavelength of the transmitting frequency, are attached to the outer surface of a metallic satellite. The four elements are located in a common plane and are spaced 90 deg apart. Two adjacent elements are active elements which are fed 180 deg out of phase. The remaining two monopoles are parasitic elements which are interconnected to a load impedance for single frequency operation. Dual frequency operation may be achieved by replacing the load impedance with either a transmitter or receiver operating at a second frequency. In this case, each fed or active pair of elements uses the other pair as parasitic elements. An arrangement is also described for six monopole elements. R.B.

N70-38230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASYNCHRONOUS ADDRESS COMMUNICATION SYSTEMS
M. D. Venediktov et al 10 Apr. 1970 271 p refs Transl. into ENGLISH from the publ. 'Asinkhronnyye Adresnyye Sistemy Svyazi' Moscow, Nauka Press, 1968 p 1-271
(AD-706775; FTD-HT-23-224-69) Avail: CFSTI CSCL 17/2

New communication systems are discussed, including that of asynchronous address with code separation of channels, the general radio-frequency channel of which is used by many subscribers in the absence of the synchronization of all systems. The attention of the reader is directed to the theory and technology primarily of asynchronous address systems with frequency-time matrix, which are intended for the transmission of spoken communications. Along with the general acquaintance of the reader with the indicated

communication systems and their peculiarities, the book touches on those problems with which it is necessary to come into contact during the study and planning of such systems. Author (TAB)

N70-38237# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
REMARKS ON WARNING SYSTEM SPECIFICATIONS AND STRUCTURES
Robert D. Turner Aug. 1969 61 p
(Contract DAHC15-67-C-0011)
(AD-699157; RP-P-534; IDA/HQ-69-10632) Avail: CFSTI CSCL 15/3

Several conceptual questions dealing with warning system structures are discussed, including techniques for correlating the outputs of multiple warning systems that compose a warning complex. The discussions are illustrated by a number of elementary analyses, dealing with warning probabilities, false-warning rates, and warning times. The mathematical calculations pertain to hypothetical automatic event detectors and automatic decision systems employing the outputs of such detectors. It is demonstrated that the use of multiple sensing elements in a warning system implies a need for proper association of redundantly detected signatures of real events and false signatures. The consequences of imperfect association are false-warning rates that can exceed by a considerable factor the rates that would be obtained assuming perfect association and when undesired warnings are generated in response to nonbelligerent activities. Author (TAB)

N70-38297# Naval Research Lab., Washington, D.C.
APPLICATIONS OF WALSH FUNCTIONS
C. A. Bass, ed. 1970 285 p refs Proc. of Symp. and Workshop, Washington, D.C. 31 Mar.-3 Apr. 1970 Prepared in Cooperation with Md. Univ.
(AD-707431) Avail: CFSTI CSCL 9/4

Hardware and designs for sequency filters based on Walsh functions are discussed. Walsh function applications in optimal linear systems, complex signals, signal multiplexing, communications, and sequency multiplex systems are considered, along with Walsh multiplexed signal transmission and bandwidth requirements. The generation of Walsh functions as binary group codes and the use of the function generator for other functions are described, as well as characteristics of parametric amplifiers, antenna radiation patterns, pattern recognition, signal processing, and the switching theory. Mathematical applications of Walsh functions include: approximation and representation of binary random variables in joint probability distributions; matrix multiplication and invariant properties under affine groups of Hadamard transforms; a logical Walsh-Fourier transform, experimental Hadamard-transform spectroscopy; discrete complex function; image classification and digital image processing; and matrix inversion. Workshop studies discussed include: Walsh functions and Hadamard matrices; function approximation by Walsh-Fourier series, Walsh-Fourier transforms; linear system theory; spectrum analysis; analog sequency filters, analysis, and synthesis of voice signals; analog to digital multiplexing; electromagnetic Walsh waves in communications; and sine and Walsh waves in physics. J.M.

N70-38304# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
RESEARCH ON EXTREMELY LOW FREQUENCY PROPAGATION WITH PARTICULAR EMPHASIS ON SCHUMANN RESONANCE AND RELATED PHENOMENA. PART 2: LOCATION OF SOURCES Final Report, 15 Jan. 1965 - 15 Nov. 1969
John Toomey and Charles Polk 1 Apr. 1970 198 p refs
(Contract AF 19(628)-4950)
(AD-706873; AFCRL-70-0226; FR-4950/4-Pt-2) Avail: CFSTI CSCL 4/1

Experimental techniques for the measurement of natural extremely low frequency (ELF) electromagnetic noise are described, including methods for absolute calibration of magnetic and electric field sensors in this frequency range (3 to 30 Hz). After a review of the theory applicable to earth-ionosphere cavity resonances a method is developed which permits location of two simultaneously active, major thunderstorm regions on the surface of the earth by analysis of ELF spectra. In particular use is made of electric to magnetic field ratios and of ratios involving the power spectrum magnitudes at adjacent resonant peaks. Limitations of the method are analyzed, particularly those related to frequency alpha background noise and to quasi-uniformly distributed, minor lightning activity which adds to the noise originating in the major thunderstorm regions. Appropriate methods of spectral analysis--appropriate frequency resolutions and integration times--are determined and the method is illustrated by experimental data. It is also indicated how the source location procedure--in conjunction with exact data (plus or minus 0.25 Hz) describing the position of the resonant peaks--may be used to evaluate ionospheric conductivity profiles extending downward to about 40 km. Author (TAB)

N70-38314*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND DEVELOPMENT OF A UHF CORRELATOR [ETUDE ET REALISATION D'UN CORRELATEUR UHF]
B. Pando Sep. 1970 82 p refs Transl. into ENGLISH of French report EUR-CEA-FC-547 p 1-82
(NASA-TT-F-13232; EUR-CEA-FC-547) Avail: CFSTI CSCL 09E

Design of high-frequency correlator capable of examining signals in the 1 MHz - 1 GHz band is discussed. Correlation functions are defined according to class of signals. A review is made of chief utilizations of correlation functions. The practical production of the correlator is described. Correlator principle consists in using one or two conventional sampling oscilloscopes making random pairs of samples in noise, adding together products of these couples according to their lag in a multiaddress memory in order to remove noise. Some experimental results carried out to confirm correlator operation are described. Comparison is made with the LETI correlator and known signals are used. Chief advantages of the correlator are wide passband, great sensitivity, an unlimited duration of integration, and low cost price. The only disadvantage is its low efficiency compared to the LETI and other real time correlators. Author

N70-38328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO DIRECTION FINDING: SELECTED PORTIONS FROM CHAPTER 5
V. A. Vartanesyan et al 23 Jan. 1970 38 p Transl. into ENGLISH from Radiopelengatsiya (Moscow), 1966, p 127-150
(AD-706197; FTD-MT-24-384-69) Avail: CFSTI CSCL 17/3

The book presents theoretical principles of radio direction finding, principles of operating various types of radio direction finders, as well as problems of practical application of ground devices. Special attention is given to the precision of radio direction finding and sensitivity of the devices depending on the conditions of radio wave propagation and on the scheme determinations of antennae and receiver-indicator systems. The various uses of radio direction finders are shown. TAB

N70-38349# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
A STUDY OF DOUBLE-SIDED INTERSYMBOL INTERFERENCE IN DIGITAL DATA COMMUNICATION SYSTEMS
Neil M. Schmitt and James L. Melsa 30 Nov. 1969 143 p refs
(Contract F44620-68-C-0023)
(AD-706926; AFOSR-70-0605TR) Avail: CFSTI CSCL 9/4

Modern digital data communication systems demand a high rate of transmission and often use pulse amplitude modulation. These systems are useful only when the effects of intersymbol interference (ISI) and noise can be simultaneously reduced to the point where data transmission is reliable. Systems where ISI is introduced in the current pulse by the pulses preceding it have been studied extensively but little attention has been given those systems in which the ISI is double-sided (DSISI). That is, both past and future pulses contribute to the interference in the current pulse. One class of systems in which DSISI plays an important role consists of those systems which use magnetic data storage. Recent advances in the technology of large capacity data storage systems which use magnetic storage techniques have opened new areas of possible large scale digital data communication system applications. However, because of detection procedures that are currently being applied, the bit density of such systems is limited to approximately 1000 bits per inch (BPI). This research investigates two new methods by which the effects of DSISI can be eliminated or reduced in the above class of systems and develops error expressions or bounds by which the performance of these systems can be evaluated as a function of the bit density. Author (TAB)

N70-38354# Texas Univ., Austin. Electronics Research Center.
OPTIMIZATION OF THE GEOMETRY OF DISTRIBUTED APERTURE RECEIVERS Interim Report
Billy Boverie and W. D. Gregg 3 Nov. 1969 115 p refs
(Grant AF-AFOSR-0766-67E)
(AD-706892; AFOSR-70-0231TR; TR-80) Avail: CFSTI CSCL 9/5

This research analytically develops an optimal spatial distribution of aperture for enhancing array reception. The optimization is carried out for three types of noise fields and for both spatially constrained and spatially unconstrained array element geometry. The noise fields considered are those due to (1) noise sources uniformly distributed in a volume around the array (isotropic noise), (2) noise sources uniformly distributed on an unbounded plane, and, (3) directive noise fields such as due to a point source. The optimality criterion employed is minimization of the detection error probability for the array situation. For a phased array this is equivalent to maximization of the array detectability gain function which has the effect of maximizing the predetection signal-to-noise ratio. Situations under which such a criterion is valid are discussed and the associated time-optimal receiver structures for these situations are given. Author (TAB)

N70-38359# Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
SHORT-TERM PREDICTIONS ON THE COURSE OF POLAR CAP ABSORPTION Final Report, Part 2, 1 Apr. 1968 - 31 May 1969
Leif Owren Dec. 1969 129 p refs
(Contract F19628-68-C-0308)
(AD-706412; AFCRL-69-0541-Pt-2) Avail: CFSTI CSCL 17/2

Part II of the Final Report presents the tapes of computer printouts generated by the computerized procedure for short-term prediction on the future course of a polar-cap-absorption event, as described in Part I of the Final Report. The printouts resulted from the use of the programs RISE, DECAY, and NITEREC in the prediction process for each of the 4 PCA events which began in 7 July 1958, 31 March 1960, 5 April 1960, 4 May 1960. Author (TAB)

N70-38368# Syracuse Univ. Research Corp., N.Y.
THE EFFECT OF METEOROLOGICAL CONDITIONS ON THE TRADE WIND DUCT AND RELATED RADIO WAVE PROPAGATION Technical Report, 1 Mar. 1969 - 28 Feb. 1970
L. G. Rowlandson and H. W. Meredith Bedford, Mass. ESD Feb. 1970 160 p refs
(Contract F19628-69-C-0208)
(AD-706132; ESD-TR-70-123) Avail: CFSTI CSCL 17/2

The horizontal extent and the intensity of the Trade Wind inversion are controlled by meteorological conditions. The subtropical area of the Caribbean is influenced by subsiding air which tends to produce a temperature inversion around one kilometer above the sea surface. The vertical transport of water vapor is thereby inhibited and a boundary forms along the inversion with moist air below and dry air above. The index of radio refraction therefore decreases rapidly with height through this layer to form an elevated duct. The meteorological situation controlling the characteristics of this duct varies from the normal high pressure condition. Interest is therefore centered on the variability of the inversion layer as affected by weather systems and local geographical conditions. Author (TAB)

N70-38407# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
EXPERIMENTAL RESEARCH AND MODELING OF REAL-TIME COMMUNICATION CHANNELS, FEEDBACK SYSTEMS
1969 157 p refs In RUSSIAN Presented at the 4th Conf., Sect. 3, of the Sci. Soviet on the Complex Probl. of Cybernetics of Acad. Sci. USSR, The Cybernetics Inst. and Computer Center of Acad. Sci. Uzbek SSR, The Inst. of Inform. Transmission Probl. of Acad. Sci. USSR, and The Sci. and Tech. Soc. of Radio Eng. and Telecommun.; Conf. on the Theory of Inform. Transmission and Coding held in Tashkent, 29 Sep. - 4 Oct. 1969
Avail: CFSTI

Various articles are presented on mathematical modeling of digital data transmission systems, error detection codes, feedback control, statistical decision theory, probability density functions in data errors, the efficiency of feedback control in multichannel communication systems with mobile units, analysis of decoding algorithms in combined systems, and the channel capacity of digital data systems. For individual titles see N70-38408 through N70-38433.

N70-38408# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
A MODEL OF A DIGITAL COMMUNICATION CHANNEL WITH VARIABLE PARAMETERS
A. A. Amosov and N. A. Aleksandrov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 5-10 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Based on the given theorem, the digital channel is constructed as a model of quantum additive noise. The state of the channel is determined by time segments in which the signal-to-noise ratio is constant. The model is demonstrated by an example of a binary channal with two gradients of validity, and generalization to a random alphabet are trivial. Transl. by R.B.

N70-38409# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
SOME CANONICAL METHODS OF INVESTIGATING THE PROPERTIES OF CHANNELS WITH MEMORY SYSTEMS
A. A. Amosov and V. I. Korzhik *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 11-17 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A method is proposed for describing the flow of errors in a discrete channel by using the variable parameter input. The given parameter may be digital or analog, may permit a purely physical interpretation, or may be hypothetical. The introduction of a canonical model with variable parameters facilitates solution of many problems of coding theory for real-time channels. Transl. by R.B.

N70-38410# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

DETERMINING THE INTERVAL OF INDEPENDENCE OF INTERNAL NOISE VALUES FOR COMMUNICATION CHANNELS

V. A. Antoshin, V. Z. Manevich, and N. A. Rubichev *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 17-21 refs In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

A digital device is described for calculating the interval of independence, which is based on the proximity between a given two-dimensional probability density function and the product of two one-dimensional probability density functions. The device can be used to calculate the interval of independence of two different random processes by employing one of three algorithms derived for given constants. Transl. by R.B.

N70-38411# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

DETERMINING AND MEASURING THE NONLINEAR COEFFICIENT OF A COMMUNICATION CHANNEL WITH CONSIDERATION OF THE STATISTICAL PROPERTIES OF REAL-TIME SIGNALS

V. A. Antoshin, V. Z. Manevich, and N. A. Rubichev *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 22-26 ref In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

Mathematical expressions are derived for measuring the nonlinear coefficient of communication channels by using a sawtooth test signal whose distortion is close to that of the real-time signal. Although the described method suggests evaluating the nonuniformity of the first derivative of the function y(x) by the criterion of uniform approximation, other criteria are useful which take into account the total change in the shape of the real-time signal at the output of the nonlinear channel. Transl. by R.B.

N70-38412# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

A MATHEMATICAL MODEL OF A BINARY CHANNEL WITH INDEPENDENT INTERVALS BETWEEN ERRORS

O. K. Bazilenko and A. F. Yewtodiyenko *In its* Experimental Res. and Modeling of Real-time Commun. Channels. Feedback Systems 1969 p 27-28 refs In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

It is shown that the grouping analysis may be carried out with respect to specifically analyzed flow characteristics, and that the constant parameter of the channel at intermediate values in the case of recursive flow does not completely reflect the extent of error grouping. A comparative analysis of the mathematical model with some earlier knowns is given. Transl. by R. B.

N70-38413# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

A MATHEMATICAL DESCRIPTION OF ERRORS IN SYMMETRICAL BINARY CHANNELS

E. L. Blokh, O. V. Popov, and Y. Ya. Turin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 29-33 refs In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

Three schemes are outlined which are special cases of the majority of known models of errors occurring during transmission of binary characters along a symmetrical channel. According to the first scheme the sequence of errors is a function of a simple Markov chain, which is a sequence of states in each of which errors with conditional probabilities occur. The second scheme is also a function of a sequency of states in each of which independent errors with conditional probabilities occur, but the sequence is binary and is a process of finite-time retrieval. The third scheme is a function of a storage process in which concepts of error bursts of specific length are used, but which are assumed to be independent of the intervals between the beginnings of the bursts rather than the intervals between bursts. Transl. by R.B.

N70-38414# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

DIGITAL CONTROL OF SIGNAL PARAMETERS IN INFORMATION-FEEDBACK TRANSMISSION SYSTEMS

V. V. Butenko and Z. M. Kanevskiy *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 34-38 ref In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

The use of feedback system in channels with variable signal strength to control the parameters of either analog or digital signals is discussed. The problem of selecting the discrete control levels is considered on the assumption that the analyzing device indicates the state of the channel without apparent errors. Transl. by R.B.

N70-38415# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

THE APPLICABILITY OF GROUP DETECTION CODES IN INFORMATION-FEEDBACK TRANSMISSION SYSTEMS

V. V. Butenko and Z. M. Kanevskiy *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 39-44 In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

The condition which a binary code in a system with logic feedback must satisfy in order that its use provide a gain interference stability is based on the concept of 'equivalent error probability.' The power gain in the logic feedback system is determined by the characteristics of the code used in the direct channel for detecting errors. Transl. by R.B.

N70-38416# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

OPTIMUM CODING IN CHANNELS WITH VARIABLE SIGNAL STRENGTH

Zh. N. Vyetshev and V. S. Misorin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 45-50 refs In RUSSIAN (See N70-38407 21-07)

Avail: CFSTI

The problem of selecting codes in interrogation system is considered for channels with randomly variable parameters. The statistical characteristics of the channel are regarded as the generalized Hilbert model for the condition that fading and fluctuating additive interference is in the main source of errors. Calculations are made for single, double, and quadruple incoherent carrier reception for the cases when the fluctuating characteristics of signal and noise amplitude are described by Rayleigh and by logarithmically normal distribution. The specific optimization function is the rate of data transmission and the restrictions are the interference stability and the set of linear codes which provide the optimum code spacing. Tabular data are presented for selecting discrete areas with corresponding optimum codes according to parameters characterizing the power ratios between signal and noise. Transl. by R.B.

N70-38417# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.

ERROR STATISTICS IN CHANNELS WITH VARIABLE SIGNAL STRENGTH

Zh. N. Vyetshev and Yu. A. Petrov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems

1969 p 51 - 57 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A model of a generalized Hilbert channel is considered with respect to communication systems in which fading and fluctuating interference are the main sources of errors. The statistics of errors in circuits of different length are investigated as a function of signal and noise characteristics by using the incoherent method of single and spaced reception.
Transl. by R.B.

N70-38418# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
SYNTHESIZING DECISION-RECEIVING ELEMENTS FOR CLOSED-LOOP DATA TRANSMISSION SYSTEMS
M. I. Dorman *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 58 - 63 In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

The optimum structure of the elements in information-feedback systems is determined on the basis of statistical decision theory. The algorithm and the values of the network parameters in the optimum structure providing the extreme of quality criteria are derived.
Transl. by R.B.

N70-38419# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
A MATHEMATICAL MODEL OF ERROR FLOW IN DIGITAL DATA TRANSMISSION CHANNELS
A. P. Duvakin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 64 - 75 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A mathematical model based on uniform Markov chains with a large number of states is constructed. The values of elements in a quasi-symmetrical transient matrix, calculated on digital computers, are taken as the model parameters. The model is used to represent certain characteristics of telephone channels.
Transl. by R.B.

N70-38420# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
THE UPPER BOUND OF DATA TRANSMISSION RATE ALONG STANDARD TELEPHONE CHANNELS IN INTERROGATION SYSTEMS
L. F. Zhigulin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 76 - 81 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A duplex interrogation system is considered in which the data transmitted in both directions is coded by the same partitioned code. The upper bound of the transmission rate is derived for the case when the statistical errors in the forward and reverse channels are described by a model developed by other authors.
Transl. by R.B.

N70-38421# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
THE EFFICIENCY OF COMPARISON CODE SYSTEMS
V. A. Kazakov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems p 82 - 86 ref In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A comparison code system with information feedback is considered in which the feedback channel contains the coding and decoding elements of the forward channel. It is assumed that an n-number of equal-probability information bits is transmitted by a binary code along the forward channel. The comparison system is characterized by several main features, such as a given error probability during the transmission of a single bit of data, an average number of repeats of a single bit of data, and an average power output upon expenditure of which the given error probability is achieved. On the basis of the general functions derived, calculations are carried out to illustrate the effect of the permissible number of repetitions and the variation of the code during repetitions in the forward channel on the efficiency of comparison systems.
Transl. by R.B.

N70-38422# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
GENERALIZED SCHEMATIC FOR DATA TRANSMISSION WITH FEEDBACK
Z. M. Kanevskiy *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 88 - 93 In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Generating function theory and probability diagrams are used to define the error probability factor for various forms of signal distortion and other characteristics of a generalized system. The diagrams may also be used to obtain expressions for dispersion, the average number of transmissions, and other exponents for generalized data transmission systems with feedback.
Transl. by E.C.

N70-38423# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
ESTIMATING THE PROBABILITY OF SIGNAL DISTORTION AND THE NUMBER OF TRANSMISSIONS IN A DATA SYSTEM WITH FEEDBACK
B. V. Tokarev and Z. M. Kanevskiy *In its* Experimental Res. And Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 94 - 99 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Formulas and graphs are used to determine the equivalent error probability in an average transmission of pulsed-coding data using feedback data transmission without memory. Distortions of servicing data under various levels of interference in direct and reverse channels are assessed. Results permit independent circuit reliability analysis of data transmissions and servicing elements when evaluating an interference-free feedback data transmission system.
Transl. by E.C.

N70-38424# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
COMPARISON OF EXPERIMENTAL AND THEORETICAL DATA ON ERROR PROBABILITY IN A MESSAGE TRANSMISSION
Yu. N. Melnikov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 100 - 104 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

The error probability was examined in a circuit under conditions of group-like channel errors. Results of calculations derived from error probability formulas are compared with test data from communication terminals separated by varying distances.
Transl. by E.C.

N70-38425# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
PREDICTING DISTRIBUTION LAWS FOR SIGNAL FADING IN SHORT WAVE COMMUNICATION CHANNELS
Yu. F. Pelegov and S. V. Moiseenko *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 105 - 112 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Methods are given for analyzing the electromagnetic

compatibility of short wave circuits under a random law of distribution for rapid fading. Experimental data are given for fluctuations in the distribution parameters in a single-beam channels. A relationship is established between changes in the reflection region and the statistical properties of the recieved signal. The feasibility is discussed of predicting distribution laws for rapid fading in a manner similar to that used for maximum usable frequency predictions. Transl. by E.C.

N70-38426# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
CHANNEL CAPACITY FOR INFORMATION SYSTEMS WITH FEEDBACK AND INTERNAL INTERFERENCE
V. V. Petrov and A. S. Uskov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 113 - 118 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

System channel capacity is examined by defining the following: (1) optimum system characteristics in accordance with the criterion of minimum mean-squared random error, ignoring the additional factor of physical feasibility; (2) data speed of the error signal; and (3) the carrying capacity. Transl. by E.C.

N70-38427# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
EVALUATION OF CHANNEL CAPACITY FOR A REAL TIME BINARY-SYMMETRICAL DATA CHANNEL
O. V. Popov and V. Ya. Turin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 119 - 124 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

The channel capacity was investigated for a binary-symmetrical channel based on multidimensional distribution of error burst length and intervals between bursts. Transl. by E.C.

N70-38428# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
TESTING OF ULTRASHORT WAVE DATA CHANNELS
O. G. Protopopov and Yu. P. Pakin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 126 - 129 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Communication test results are tabulated for data transmissions of relay stations using 25 watt transmitters and radio stations using 1.5 watt transmitters. The tests were carried out by loop patching with sequential transmission and reception of binary data. Errors were recorded and analyzed using the receiver apparatus. The digital transmitter was frequency modulated with a transmission rate of 600 to 1200 binary elements a second. Test terminals were located at distances from 6 to 55 km. The tests were conducted at time intervals such that the results are considered statistically reliable. Transl. by E.C.

N70-38429# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
THE EFFECT OF RELIABLE TRANSMISSION OF MESSAGE RECEIPTS ON THE INTERFERENCE REJECTION OF TRANSMISSION SYSTEMS WITH INFORMATION AND DECISION FEEDBACK WITHOUT MEMORY
V. V. Rumyantsev and V. V. Solovyev *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 130 - 134 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Formulas are derived for calculating the limiting probability of various types of errors and the average time of message transmission with allowance for the exchange of receipts. An approach to determining the asymmetry effect while transmitting servicing information on a level of undetected errors is discussed as well as a comparison of decision feedback and information feedback communication systems. Transl. by E.C.

N70-38430# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
THE EFFECTIVENESS OF USING FEEDBACK IN MULTICHANNEL CIRCUITS WITH MOBILE OUTSTATIONS
V. S. Sulimov and V. V. Solovyev *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 135 - 139 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Results are discussed for the computerized modeling of a multichannel mobile communication system with channel interference and decision feedback of selective calling signals. The effectiveness of the feedback system was evaluated as well as the maximum amount of repetitive selective calls required to obtain optimum channel capacity. Transl. by E.C.

N70-38431# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
PROBABILITY DISTRIBUTION OF VARIOUS NUMBERS OF ERRORS IN SEVERAL ADJOINING COMBINATIONS
V. Ya. Turin *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 141 - 148 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Formulas and models are described for determining the probability distributions required to evaluate the reliability of data transmissions. Transl. by E.C.

N70-38432# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
PROBABILITY OF INACCURATE REFLECTION OF STATUS OF DATA SOURCES IN AN ADDRESS SYSTEM WITH DELAY CODE TRANSMISSION
G. A. Shastova and L. I. Doroshenko *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 149 - 152 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

A system of N independent data sources is examined with multiple discrete states operating in a single communication channel. Each source is located in one of m states and changes in status rarely occur. The system is characterized by extensive data redundancy from each source. Using statistical coding, changes in frequency bands and interference levels are evaluated with allowance for delay errors arising when the status of several sources changes during a single cycle and data on the changes is transmitted during succeeding signal-free cycles. Transl. by E.C.

N70-38433# Academy of Sciences (USSR), Moscow. Scientific Soviet on the Complex Problem of Cybernetics.
ANALYSIS OF DECODING ALGORITHMS USED IN COMBINATION SYSTEMS WITH FEEDBACK
V. P. Shuvalov *In its* Experimental Res. and Modeling of Real-Time Commun. Channels. Feedback Systems 1969 p 153 - 156 refs In RUSSIAN (See N70-38407 21-07)
Avail: CFSTI

Combination systems are examined in which indirect error detection methods are used along with error correcting codes to determine circuit reliability. Formulas are given for calculating the probability characteristics of three decoding algorithms which take group errors into account. The effectiveness of the algorithms is compared. Transl. by E.C.

N70-38442 University of Southern Calif., Los Angeles.
CODES FOR ALMOST SURE SYNCHRONIZATION
Robert Martin Storwick (Ph.D. Thesis) 1969 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-19407

A fundamental requirement for the operation of a digital communication system is the ability to establish and maintain synchronization (sync) between transmitter and receiver. The relevant considerations in developing a statistical sync procedure are reviewed, and a particularly advantageous approach selected for further development. Basically, this synchronizer inspects the code symbol stream for the first occurrence of an event (e.g., a fixed finite length code symbol sequence) which appears in only one position relative to true word sync. This position-characteristic sync event enables the immediate establishment of word sync. The receiver can then make unambiguous sync decisions for almost every code symbol sequence it may receive, and is realized easily by using simple shift register constructions. Results on the range of the average sync delay for optimally encoded sources are presented. Dissert. Abstr.

N70-38445# Institute for Telecommunication Sciences, Boulder, Colo.
SPECTRAL APPROACH TO RESOLUTION OF RADAR PULSES IN CLUTTER. 2: EXPERIMENTAL VERIFICATION
Interim Report
Herman V. Cottony and Alvin C. Wilson (NBS, Boulder, Colo.) 20 Feb. 1970 37 p refs
(Contract PRO-CP-69-824; AF Order CP-67-823)
(AD-706895; ESSA-SR-B-4; AFCRL-70-0113; Rept-4600000-D51124680) Avail: CFSTI CSCL 17/9

A report considered theoretically returns from complex radar targets consisting of several non-resonant scatterers at different ranges. It showed that the power spectrum of such return is given by a constant term plus a series of cosine terms. This report presents the results of experimental work designed to verify the earlier deduction. Experimental measurements consist of photographs of oscilloscope displays for various juxtapositions of two, nearly identical, non-resonant scatterers. The experimental results confirm that the radar returns from a complex target consisting of two scatterers have a constant term and a cosine term. The period of the cosone term is inversely proportional to the separation between the two scatterers. Measured results confirm those predicted by the theory for scatter separations from 0.40 to 3.00 m. Author (TAB)

N70-38463# Stanford Research Inst., Menlo Park, Calif.
STEP FREQUENCY RADAR STUDY OF SECEDE 3 BARIUM RELEASE Final Report, Nov. 1968 - Mar. 1970
Howard F. Bates Dec. 1969 110 p refs
(Contract DASA01-69-C-0032)
(AD-706751; DASA-2409) Avail: CFSTI CSCL 17/9

The purpose of this project was to determine the behavior of the backscatter cross section in the HF to low VHF region from barium clouds in the lower F layer. The hope was that these data would provide a basis for understanding the mechanism of radio-wave scatter from barium clouds. It is believed that the results of this study have indeed led to a better understanding of the scattering processes involved, although in the course of the study as many new questions were raised as were answered. An unfortunate combination of circumstances from the standpoint of our radar experiment led to the result that usable amplitude data were obtained from only one release, making the general applicability of some of the results open to question. Author (TAB)

N70-38474# Delaware Univ., Newark. Dept. of Electrical Engineering.
QUANTUM LIMITATIONS TO ELECTROMAGNETIC SIGNAL MEASUREMENTS Interim Scientific Report, 1 Jan. - 31 Dec. 1969
Paul L. Bolgiano, Jr. and Bruce C. Lutz Jan. 1970 20 p refs
(Grant AF-AFOSR-0002-67)
(AD-706930; AFOSR-70-0764TR) Avail: CFSTI CSCL 17/8

Scientific results are reported on work directed toward obtaining the understanding of the fundamental principles of photoelectron counting statistics needed for the application of photoelectron counting as a means of demodulating low intensity optical communication signals. A simulated optical communication system featuring a photoelectron counter system was assembled and made functional. A mathematical representation was developed which permits representing photoelectron counts similarly to noisy communication signals. The Poisson transform signal representation, developed previously, was applied to digital filtering. Author (TAB)

N70-38480# Air Force Systems Command, Wright-Patterson AFB, Ohio.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 11, NO. 4, 1967
A. E. Gershberg et al 26 Jan. 1970 55 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 11, no. 9, 1967 p 30 - 46, 50 - 56
(AD-706194; FTD-MT-24-365-69) Avail: CFSTI CSCL 17/2

Contents: Influence of television channel and camera on image uniformity; Calculation of pulse resoluting in television; A new photoelectric converter-the scanistor; Resolving power variable focal length objectives for 8-mm movie cameras. TAB

N70-38482# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
DETERMINATION OF THE GROUP VELOCITY DELAY OF A VHF SIGNAL PENETRATING THE IONOSPHERE BY MEASURING THE FARADAY ROTATION USING SIGNALS OF THE ATS-3 SATELLITE [BESTIMMUNG DER GRUPPENLAUFZEITVERZOEGERUNG EINES VHF-SIGNALES IN DER IONOSPHAERE AUS MESSUNGEN DER FARADAY-ROTATION MIT SIGNALEN DES SATELLITEN ATS-3]
W. Dieminger, G. Schmidt, and K. Oberlaender Apr. 1970 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-24) Avail: CFSTI; ZLDI Munich: 8.30 DM

In order to determine the group-velocity delay of a VHF-signal in the ionosphere, which was required for a navigation experiment, measurements were made of the Faraday-effect on VHF-signals from the geostationary satellite ATS-3. In addition critical frequencies foF2 from Breisach (West Germany) and Tortosa (Spain) were also used. Author (ESRO)

N70-38588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 11, no. 9, 1967
I. A. Rosselevich et al 27 Jan. 1970 51 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 11, no. 9, 1967 p 13 - 18, 27 - 32, 43 - 48
(AD-706198; FTD-MT-24-370-69) Avail: CFSTI CSCL 17/2

Contents: Small-frame method in television space systems; Permissible values of distortion in cinematographic systems; and Methods of scale control of parameters on a television screen. TAB

N70-38621# Army Foreign Science and Technology Center, Washington, D.C.
RADAR METHODS FOR THE SELECTION OF MOVING TARGETS (A TEXTBOOK) [RADIOLOKATSIONNYE METODY SELEKTSII DVIZHUSHCHIKHSYA TSELEY]

P. A. Bakulev 27 Feb. 1970 111 p refs Transl. into ENGLISH of the book "Radiolokatsionnye Metody Selektsii Dvizhushchikhsya Tseley" Moscow, 1958
(AD-706486; FSTC-HT-23-830-70; RA-007-68) Avail: CFSTI CSCL 17/9

The text explains basic radar methods for the selection of moving targets (SDTs) and their use in systems used to select moving targets. The characteristics of signals from moving and fixed targets, as well as those of interference signals, are given. Methods for compensating for signals from fixed objects are reviewed. Operational features of various SDTs systems are analyzed, various factors which effect the performance of selection devices are reviewed, as are ways in which to improve the quality of the selection in SDTs radars. TAB

N70-38661# Innsbruck Univ. (Austria).
PROPERTIES OF SMALL HELICAL ANTENNAS AT LOW FREQUENCIES FOR APPLICATION IN DISSIPATIVE MEDIA
R. Lukavec 15 Nov. 1969 34 p refs
(Contract F61052-69-C-0007)
(AD-707141; AFCRL-70-0285; SR-3) Avail: CFSTI CSCL 9/5

An equivalent circuit diagram for a network model has been used for discussing the properties of small, self-resonant helical antennas at low frequencies. It is shown how to calculate the lowest resonant frequency, wave resistance, input resistance and the distribution of current and charge. The surrounding media are air and water. The theoretical values are compared with theory by means of two antennas; good agreement has been found. Author (TAB)

N70-38756# Ohio State Univ., Columbus. ElectroScience Lab.
THE TRANSIENT FIELDS OF DIPOLE ANTENNAS IN THE PRESENCE OF A DIELECTRIC HALF-SPACE
D. A. Hill and D. L. Moffatt 13 Mar. 1970 54 p refs
(Contract F44620-67-C-0095)
(AD-707106; OSURF-2467-2; AFCRL-70-0016; SR-4) Avail: CFSTI CSCL 17/9

The transient fields produced by vertical and horizontal electric dipoles with impulsive current excitation in the presence of a half-space are considered. For special source and observer configurations, exact, closed form expressions for the fields produced by impulsively excited dipoles above a nondispersive half-space are given. For the dispersive case, estimates of the transient fields from asymptotic approximations are given. A knowledge of the interactions of dipole antennas and a half-space is useful for studies of the background return from the half-space and for studies of the scattering by small targets on or near the half-space. Author (TAB)

N70-38774# Institute for Defense Analyses, Arlington, Va. Jason Div.
MULTIPLE SCATTERING CORRECTIONS TO WAKE DOPPLER SPECTRA
Kenneth M. Watson Mar. 1970 32 p refs
(Contract DAHC15-67-C-0011)
(AD-707316; IDA/HQ-70-11241; RP-P-601) Avail: CFSTI CSCL 17/9

The radiation transport equation is used to study wake Doppler spectra. To simplify the calculation, a slab geometry is assumed for the wake. When the wake is absorbing, little spreading beyond that of the first Born approximation is observed. For non-absorbing wakes spreading beyond that of the Born approximation is found for thick wakes. Multiple scattering corrections to the spectra seem to set in rather slowly as the wake becomes thick, however. Author (TAB)

N70-38797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POWER RATIO OF WANTED TO UNWANTED SIGNALS FOR FREQUENCY SHARING BETWEEN FM AND AM-VSB TELEVISION TRANSMISSION SYSTEMS
Edward F. Miller and Royce W. Myhre Washington Sep. 1970 41 p refs
(NASA-TM-X-2080; E-5627) Avail: CFSTI CSCL 17B

Experiments are described which determine that for barely perceptible interference, an interfering FM signal in the passband of an AM-VSB television channel should have an average power level from 37 to 48 db below the sync peak average power of the AM-VSB signal, at the AM receiver input. Conversely, an AM-VSB interfering signal should have a sync peak average power level from 16 to 26 db below the average power of the FM signal, at the FM receiver input. The experimental results are used to evaluate frequency sharing between an FM transmitter in synchronous orbit and an AM-VSB television system on earth. Author

N70-38829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIGITAL PROCESSING OF RADAR INFORMATION: SELECTED CHAPTERS
S. Z. Kuzmin 6 Feb. 1970 256 p refs Transl. into ENGLISH of the book 'Tsifrovaya, Obrabotka Radiolokatsionnoi Informatsii, Moscow, 1967 p 152 400
(AD-706201; FTD-MT-24-441-69) Avail: CFSTI CSCL 17/9

The book deals with statistical theory of primary and secondary processing of data obtained from radar stations of scattering observation carried out by digital computers. It also deals with problems of algorithm processing of radar data and with problems of using these algorithms on digital automatic devices and digital computers. The report covers Chapters three and four of the parent document. TAB

N70-38848*# Technology for Communications International, Mountain View, Calif.
THEORETICAL ANALYSIS OF DIPOLE ANTENNA CHARACTERISTICS ON THE RAE SATELLITE, PART 2 Draft Final Report
Jul. 1970 251 p
(Contract NAS5-11256)
(NASA-CR-112966; TCI-2236) Avail: CFSTI CSCL 17B

The material presented is divided into three main categories: (1) principle-plane radiation patterns for dipole in presence of V-antennas and liberation damper; (2) current distributions for dipole alone on satellite; and (3) radiation patterns for dipole alone on satellites. For Part 1 see N70-37959. D.L.G.

N70-38866# Joint Publications Research Service, New York.
TRANSMISSION OF SECAM COLOR TELEVISION SIGNALS WITH SOUND PORTION VIA MOLNIYA-1 COMMUNICATION SATELLITE
L. A. Sevalnev 28 Aug. 1970 5 p refs Transl. into ENGLISH from Elektrosvyaz (USSR), no. 5, 1970 p 46 49
(JPRS-51265) Avail: CFSTI

A method was devised to transmit audio and video color television signals, via communication satellites, by modernizing equipment in existing satellite communications and ground receiving systems. Requirements for the system include more rigid tolerances for the stability of time intervals of a combined television signal, audio racks, and correcting devices to adjust the amplitude frequency shape of the video channel in the region of the color subcarrier. Results indicate that the method provides the necessary changes to transmit both black and white and color broadcasts. E.H.W.

N70-38870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROS AND CONS OF ORBITA TELEVISION SATELLITE SYSTEM DISCUSSED

Yu. Koginov 25 Feb. 1970 10 p Transl. into ENGLISH from Pravda (Moscow), 8 Feb. 1970 p 3
(AD-707311; FTD-HT-23-142-70) Avail: CFSTI CSCL 17/2

A brief news article is presented of the Soviet Orbita, an artificial earth satellite system which now transmits television pictures and sound to 65 percent of the USSR. The next Five Year Plan will see a climb in this figure, 82 to 85 percent. A special seminar on Orbita programming was held in Ulan Ude in the fall of 1969. It was attended by station representatives from cities in Siberia and the Far East. In addition to remarks concerning delays and disruptions in transmissions, the group also heard serious complaints against programming management and content.
Author (TAB)

N70-38918# Army Foreign Science and Technology Center, Washington, D.C.
SHORTWAVE ANTENNAS
G. Z. Aizenberg 2 Mar. 1970 71 p refs Transl. into ENGLISH from Korotkovolnovye Antenny (Moscow), 1962 p 1-814
(AD706545; FSTC-HT-23-829-70) Avail: CFSTI HC $10.00/MF $0.65 CSCL 9/5

The monograph is a revision of the book Antennas for Shortwave Radio Communication published in 1948. Included are such newer antennas as broadside multiple times antennas and in particular broadside antennas with untuned reflectors, traveling wave antennas with pure resistance coupling, logarithmic antennas, multiple-tuned shut dipoles and others. The material on rhombic antennas was expanded and new chapters on single-wire traveling antennas and on the comparative noise stability of various receiving antennas.
Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-37613# Worcester Polytechnic Inst., Mass.
ON-LINE DATA ANALYSIS WITH A HYBRID COMPUTER AND INITIAL STUDY OF A SOUNDING ROCKET HYBRID SIMULATION
Owen W. Kennedy, Jr., Donald C. Eteson, and Romeo L. Moruzzi 7 Oct. 1969 38 p refs
(Contract F19628-69-C-0125)
(AD-706126; AFCRL-70-0067; SR-1) Avail: CFSTI CSCL 19/4

Hybrid computer programs were developed to accept data in analog form and simultaneously to perform selected analysis and reduction procedures in real time, the results appearing as continuous analog outputs. Analog circuits with parallel logic removed interference spikes from the original data, generated a coarsely-quantized power density spectrum, and formed a continuous record of the correlation coefficient of two signals. Hybrid programs calculated, and repetitively outputed in analog form, the amplitude probability density and the auto- or crosscorrelation functions; a rapid-display program continuously outputed the peak value of the crosscorrelation and the time at which the peak occurred. Initial data conditioning and final display utilized analog circuits, but the calculation was performed on a digital computer linked by a-d and d-a converters and control circuits. An initial study of hybrid techniques for simulating the flight of sounding rockets and reconstructing aspect data was performed.
Author (TAB)

N70-37642# Argonne National Lab., Ill.
APICS: A COMPUTERIZED AIR POLLUTION DATA MANAGEMENT SYSTEM
C. Chamot, A. S. Kennedy, E. J. Croke, J. J. Roberts, H. Moses et al Feb. 1970 382 p
(Contract W-31-109-eng-38)
(ANL/ES-CC-6) Avail: CFSTI

A computerized system, was developed as an aid to research associated with the Chicago air Pollution System model project, is described. The APICS air pollution information and computation system includes programs to create and maintain master files of meteorological and air pollution data, to search master files for desired information, and to pass the data to the analysis and computation programs. A multiple source atmospheric dispersion model program may be used to calculate projected pollution levels. Other programs provide graphical and printed display of selected data and results of statistical analysis, including tables for predicting local pollution levels based on meteorological phenomena. The manual documents those aspects of the system which may be generally applied to similar situations in other cities are documented, and ways in which other data types and analysis programs could be incorporated into the system are indicated.
Author

N70-37643# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center
ADSEP: AN AUTOMATED DATA SET EDITING PROGRAM
A. A. Brooks 12 May 1970 102 p
(Contract W-7405-eng-26)
(CTC-34) Avail: CFSTI

In order to cope with the vagaries of practical data reduction, a new data set editing program (ADSEP) was written to provide the flexibility needed with automation of as much of the tedium as possible. It can deal with any portion of a record using an alphabetic designation of that portion. At the same time, the program will permit accessibility to the record at any level of programming sophistication in order that specialized adaptations can be made. The main program manipulates data through user-specified subroutines and a set of editing subroutines. It also provides automated pointer calculations and record array construction. These improvements enable a general-purpose input/output subroutine to be defined, and such a subprogram is included as well as its allied list handling subprograms. Flexibility is provided by user-supplied initialization which defines the record structure, input and listing formats, and data reduction procedures.
Author

N70-37644# Illinois Univ., Urbana. Dept. of Computer Science.
DEC PDP-8 INTERFACE TO IBM 2701 PDA
C. E. Carter, H. E. Lopeman, M. J. Miller, and R. L. Miller Mar. 1970 52 p
(Contract AT(11-1)-1469)
(COO-1469-153; Rept-372) Avail: CFSTI

A maintenance manual for the DEC PDP-8 communications link to the IBM 2701 Parallel Data Adapter hardware is presented. The signal connections, and hardware are discussed with block diagrams. Programming and operation instructions are also included.
F.O.S.

N70-37653# Stanford Linear Accelerator Center, Calif.
FORMULARY MODEL FOR ACCESS CONTROL AND PRIVACY IN COMPUTER SYSTEMS
Lance J. Hoffman May 1970 88 p refs
(Contract AT(04-3)-515)
(SLAC-117) Avail: CFSTI

This formulary model is independent of both machine and data base structure, and is sufficiently modular to allow cost-effectiveness studies on access mechanisms. Access control is based on sets of procedures called formularies. The decision on whether a user can read, write, update, etc., data is controlled by programs (not merely bits or tables of data) which can be completely independent of the contents or location of raw data in the data base. The decision to grant or deny access can be made in real time at data access time, not only at file creation time as

has usually been the case in the past. Indeed the model presented does not make use of the concept of files, though a specific interpretation of the model may do so. Access control is not restricted to the file level or the record level, although the model permits either of these. If desired, however, access can be controlled at arbitrarily lower levels, even of access control in the model. Moreover, each element of raw data need appear only once, thus allowing considerable savings in memory and in maintenance effort over previous file-oriented systems. Author

N70-37665# Battelle-Northwest, Richland, Wash. Control and Instrumentation Dept.
ERRORS AND ERROR COMPENSATION IN HYBRID COMPUTERS
R. A. Burnett. May 1970. 38 p. refs
(Contract AT(45-1)-1830)
(BNWL-1356) Avail: CFSTI

The major types of computing errors generated by the analog-to-digital and digital-to-analog converters and the digital computer in a hybrid system are identified and discussed. Included are quantization, roundoff, and time-delay errors. Compensation methods for reducing these errors are proposed and discussed. Sample problems were run in which digital computer and hybrid interface parameters, such as speed and word length, were effectively varied by software methods to simulate different levels of equipment capability. The resulting effects upon solution errors are documented. The effects of various compensation techniques are also documented. Conclusions indicate that many simulation problems can be solved quite satisfactorily with relatively inexpensive and unsophisticated hybrid computing equipment. Author

N70-37671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIRECT DIGITAL COMPUTER DATA FEED FROM TELEGRAPH COMMUNICATION CIRCUITS
O. I. Leonov. 8 May 1970. 11 p. refs. Transl. into ENGLISH from Avtomat. Telemekhan. i Svyaz (Moscow), v. 2, no. 8, 1968 p. 18 - 20
(AD-707177; FTD-HT-23-210-70) Avail: CFSTI CSCL 9/2

For interfacing electronic digital computers to telegraph communication trunks the most effective systems are those which feature direct data input to the computer, namely, software. The magnetic-drum interface reported on in this article can be used in a data transmission and reduction system at a railroad computer center as a possible configuration for direct data input to the computer from telegraph circuits. Author (TAB)

N70-37682# Tracor, Inc., Austin, Tex.
RESEARCH IN SEMIOTIC SYSTEMS Final Report, Apr. 1967 - Apr. 1970
Theodore W. Ziehe. Apr. 1970. 44 p. refs
(Contract N00014-67-C-0396)
(AD-707063; T-70-AU-7243-U) Avail: CFSTI CSCL 9/2

The report documents a research effort regarding the architecture of computer-based semiotic systems. It sketches the concept of a computer-based semiotic system and briefly describes work done in two technical areas important to such systems--data management and process management. A software base upon which to construct a semiotic system is being implemented. That base is also described. Finally, the report outlines several areas of future work suggested by the progress made to date. Author (TAB)

N70-37690# Sandia Corp., Albuquerque, N.Mex.
MAGNETICALLY SETTABLE COUNTER
May 1970. 15 p. Sponsored by AEC
(SC-M-70-273) Avail: CFSTI

The basic counting function of the manually settable magnetic wire counter is obtained as a time delay between the insertion of a magnetic count domain and the generation of an output voltage signal. The output signal from the shift register is obtained as a voltage signal induced in a multiturn sense winding, placed around the wire at the output end of the shift register. Author

N70-37692# California Univ., Berkely.
QSPL REFERENCE MANUAL
L. P. Deutch and B. W. Lampson. 20 Feb. 1969. 49 p. revised
(Contract ARPA SD-185)
(AD-707383; R-28) Avail: CFSTI CSCL 9/2

The document is a brief but complete description of a new language invented and implemented by the authors. The language is intended to be a suitable vehicle for programs which would otherwise be written in machine language for reasons of efficiency or flexibility. It is part of a system which also includes a compiler capable of producing reasonably efficient object code and a runtime which implements the input-output and string-handling features of the language as well as a fairly elaborate storage allocator. The system automatically takes care of paging arrays and blocks from the drum if they have been so declared. TAB

N70-37698# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LEIS-UM TEACHING COMPUTER
A. S. Fainberg. 20 Apr. 1970. 11 p. Transl. into ENGLISH from Tr. Nauch.-Tekh. Konf. Leningrad. Elek.-Tekh. Inst. Svyazi (USSR), no. 1, 1964 p. 143 - 147
(AD-707297; FTD-MT-24-59-70) Avail: CFSTI CSCL 9/2

The article gives a short description of a digital electronic computer intended for instruction of students in the course fundamentals of computing technology. Author (TAB)

N70-37702# Naval Postgraduate School, Monterey, Calif.
THE GENERAL INFORMATION PROCESSING SYSTEM (GIPSY)
John Duffield Cooper, Jr. (M.S. Thesis) Dec. 1969. 107 p. refs
(AD-706712) Avail: CFSTI CSCL 9/2

The paper describes the General Information Processing System, a computer program designed to serve a variety of information processing applications. An input deck to the program is composed of a data base and a description of the processing tasks to be performed on those data. A typical task would be to screen the data base according to given criteria and then output information from the data that met the criteria. For output, the system has flexible formatting capabilities. Included in the paper is an example of a bibliographical application, complete with a listing of the input deck and the output that was produced. Detailed instructions are given on how to prepare an input deck. A description of system implementation is included. Author (TAB)

N70-37705# Illinois Univ., Urbana. Dept. of Computer Science.
TRANSFORMATRIX: AN IMAGE PROCESSOR INPUT AND STOCHASTIC PROCESSOR SECTIONS
Orin Edward Marvel (Ph.D. Thesis) Apr. 1970. 124 p. refs
(Contract AT(11-1)-1469)
(COO-1469-161; Rept-393) Avail: CFSTI

A scheme of picture processing at television rates is proposed, in which a two dimensional input picture is linearly transformed into an output picture. The input image processor, stochastic processor, and input display channel are described. The input image processor applies the asymetrical rise and fall time of a photoconductor to dynamically convert a scanned television image into parallel form. A computer model of the television-photoconductor dynamics is derived. The stochastic processor converts the input signals to synchronous random pulse sequencies and performs the

1024 parallel multiplications. A study of pseudo-random number generation and an error analysis of random pulse sequence representation is discussed. The input display channel multiplexes the input pictures in order to display the input image. It also allows the operator to select a linear or logarithmic sensation display. A theorem relating the accuracy of the stochastic processor to the resolution of the picture processed is derived. Author

N70-37707# Network Analysis Corp., Glen Cove, N.Y.
ANALYSIS AND OPTIMIZATION OF STORE-AND-FORWARD COMPUTER NETWORKS
Semiannual Technical Report, 15 Oct. 1969 - 15 Jun. 1970
Howard Frank 15 Jun. 1970 68 p refs
(Contract DAHC15-70-0120; ARPA Order 15)
(AD-707438; SATR-1) Avail: CFSTI CSCL 9/2

The report discusses the analysis and optimization of the ARPA Computer Network. The general design philosophy followed as well as the specific elements considered in the implementation of this philosophy are described. Relationships between traffic level, link capacities, and cost as a function of the number of nodes in the networks have been investigated. Extensive studies have been made for twelve, sixteen, eighteen, and twenty node networks where each node was a potential site for the ARPA Network. Results of these studies are summarized. Methods for optimizing the design of centralized networks have been discovered. These methods, which are described here, are presently being used to design large decentralized networks. TAB

N70-37736# California Univ., Livermore. Lawrence Radiation Lab.
INTERACTION OF COMPUTER GRAPHICS AND ADVANCED INSTRUMENTATION
G. A. Michael [1970] 6 p refs Presented at Instr. Soc. of Am. Meeting, 11-13 May 1970 Supported by AEC
(UCRL-72414) Avail: CFSTI

Computers and digital techniques utilized by instruments makers are reported. In some cases the computer becomes an integral part of the instrument, while in others it is fundamental to the design and construction phase. Such applications result in better devices that in turn are having their won effects on many facets of the computer industry. Some of these effects are examined with special attention to storage and visual data processing. Author

N70-37750# California Univ., Berkeley.
DDT: INTERACTIVE MACHINE LANGUAGE DEBUGGING SYSTEM REFERENCE MANUAL
Mark L. Greenberg 15 Jun. 1969 25 p
(ARPA SD-185)
(AD-707406; R-39) Avail: CFSTI CSCL 9/2

DDT is the debugging system for the SDS 930 Time-Sharing System. It has facilities for symbolic reference to and typeout of memory cells and central registers. Futhermore, it permits the use of literals in the same manner as in the assembler. It can also insert breakpoints into programs, perform a trace, and search programs for specified words and specified effective addresses. In addition, there is a powerful conditional breaking facility that will allow the user to specify the exact condition under which he wants the program to break. Finally, DDT can load both absolute and relocatable files in the format produced by the assembler. TAB

N70-37752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COORDINATION BETWEEN THE UP-1 CONVERTER AND THE COMPUTER ELECTRONIC DNIEPER OPERATING JOINTLY IN AN ANALOG-DIGITAL COMPUTER COMPLEX
M. D. Ventdel et al 31 Mar. 1970 15 p Transl. into ENGLISH from Tr. Upravlyayuschie Mashiny i Sistemy (USSR), no. 1, 1968 p 29-37
(AD-707296; FTD-MT-24-48-70) Avail: CFSTI CSCL 9/2

The UP-1 digital-analog converter is intended for coordinating the operation of the M-20 digital computer with various analog computers. Substitution of the Dnepr-1 computer for the M-20 involved solution of the following problems: (1) as the Dnepr-1 delivers negative 7-v pulses while the Up-1 requires positive 40-50-v pulses, some circuits and assemblies in the Up-1 were altered; (2) special instructions were worked out for feeding digital information into the UP-1 and for taking it out; a simultaneous exchange of information would require 45 binary digits; only 26 digits were available in the Dnepr-1; 3 definitely space pulses are required for access to the UP-1; hence, such pulses had to be designated from those available in the Dnepr-1. Changes in schematics are shown. TAB

N70-37780# Boeing Scientific Research Labs., Seattle, Wash.
UTILITY: A CTS PROGRAM FOR TAPE, DISK, CARD, AND PRINTER INFORMATION HANDLING
Randy L. Allen and Rodney H. Allen May 1970 41 p refs
(AD-707255; D1-82-0973; Rept-4) Avail: CFSTI CSCL 9/2

UTILITY is a generalized program for information handling written for a time sharing computer system. UTILITY is a simple to use program to provide information transfer between input-output peripheral devices. Information from an input device (tape, disk, or card reader) can be sent to one or more output devices (tape, disk, card punch, and printer). A storage and execution time efficient ASSEMBLER generated MODULE will perform most applications. A FORTRAN version is available for special user modifications. The use of UTILITY is explained and demonstrated, and test timings are given. Author (TAB)

N70-37825# Illinois Univ., Urbana. Coordinated Science Lab.
AN IMPROVED PROCEDURE FOR GENERATION OF HALF TONE COMPUTER GRAPHICS PRESENTATIONS
W. J. Bouknight 1 Sep. 1969 54 p refs
(Contract DAAB07-67-C-0199)
(AD-707403; R-432) Avail: CFSTI CSCL 9/2

The function of the LINESCAN algorithm is to process the projected image of the three-space structure on the viewing plane and deliver the key squares of the scanned picture to the output routine which will construct the final photographic half-tone image. The key squares are the locations of the hardware scanning beam where the intensity function will change. These beam intensity change points are located on the viewing plane within the window near one of two places: (1) intersections between projected edges and the scanline and (2) intersection of the scanline and the projection of the intersection between two polygons (implicitly defined line). TAB

N70-37866# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON STOCHASTIC CONTEXT-FREE LANGUAGE
T. Huang and K. S. Fu Mar. 1970 32 p refs
(Grants AF-AFOSR-1776-69; NSF GK-1970)
(AD-706915; TR-EE-70-11; AFOSR-70-1501TR) Avail: CFSTI CSCL 5/7

In the report, normalized stochastic grammars (nsg) and stochastic pushdown automata (spda) are defined. Based on the concept of nsg, procedures for constructing the Chomsky and Greibach normal forms for normalized stochastic context-free grammars (nscfg) are presented. A stochastic context-free language (scfl) is defined in terms of a nscfg. Relationships between scfl and spda are studied. The class of languages accepted by a spda with cutpoint 0 is precisely the class of scfl. Author (TAB)

N70-37874# Stanford Univ., Calif. Electronics Labs.
AN APL MACHINE
Philip S. Abrams (Ph.D. Thesis) Feb. 1970 213 p refs

(Contract Nonr-225(83); AT(04-3)-515)
(AD-706741; SU-SEL-70-017; TR-3) Avail: CFSTI CSCL 9/2

The dissertation proposes a design for a machine structure which is appropriate for APL and which evaluates programs in the language efficiently. The approach taken is to study the semantics of APL operators and data structures rigorously and analytically. A compactly representable standard form is exhibited for select expressions, which are composed of operators which alter the size and ordering of array structures. In addition, a set of transformations is presented sufficient to derive the equivalent standard form for any select expression. The standard form and transformations are then extended to include expressions containing other APL operators. By applying the standard form transformations to storage access functions for arrays, select expressions in the machine can be evaluated without having to manipulate array values; this process is called beating. Drag-along is a second fundamental process which defers operations on array expressions, making possible simplifications of entire expressions through beating and also leading to more efficient evaluations of array expressions containing several operations. The APL machine consists of two separate sub-machines sharing the same memory and registers. The D-machine applies beating and drag-along to defer simplified programs which the E-machine then evaluates. The major machine registers are stacks, and programs are organized into logical segments. Author (TAB)

N70-37876# System Development Corp., Falls Church, Va. Commercial Systems Div.
TIME SHARED/DATA MANAGEMENT SYSTEM, CDMS EXAMPLES ; QUERY, COMPOSE, DISPLAY
[1970] 29 p
(TID-25385) Avail: CFSTI

The Management Reporting and Control data base described in these pages is based on the PERT project control method. The data base is designed specifically for practical day-to-day management applications and not for theoretical or mathematical use. It is designed to give managers simple, concise answers to questions regarding completion dates, manning and costs. The data base is designed for use with CDMS, SDC's time-shared data management system. It is responsive to user needs in that queries can be answered and reports can be generated, based on the latest data immediately after the data are changed or updated. NSA

N70-37897 Utah Univ., Salt Lake City.
A HIDDEN SURFACE ALGORITHM FOR COMPUTER GENERATED HALFTONE PICTURES
John Edward Warnock (Ph.D. Thesis) 1969 32 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-19002

The representation of data in the form of line drawings, graphs, charts, diagrams and line plots was explored extensively. Techniques used to solve problems associated with extending the power of computer graphics to include black and white, and color shading are discussed. A method is presented for converting data describing three-dimensional objects into data that can be used to generate two-dimensional halftone images. Some problems that arise in black and white, and color shading are dealt with. Dissert. Abstr.

N70-37910# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
A FORTRAN PROGRAM: STABFALL
R. Hollnagel Apr. 1969 12 p refs In GERMAN
(FMRB-5/69) Avail: AEC Depository Libraries

At the time t sub o a control rod is inserted suddenly into a stable and critical reactor. Decrease of the thermal neutron flux is then considered for 60 different time intervals. Delayed neutrons are multiplied by a correction factor to account for the difference in energy distribution in comparison with prompt fission neutrons. Mathematical formulas for the problem are developed. Finally, a computer program for solution of the equations is present. NSA

N70-37970# Stanford Univ., Calif. Electronics Labs.
ALGEBRAIC PROPERTIES OF FAULTS IN LOGIC NETWORKS
Frederick W. Clegg and Edward J. McCluskey Mar. 1970 149 p refs
(Contract Nonr-225(83); Grant NSF GJ-165)
(AD-706739; SU-SEL-69-078; TR-4) CSCL 9/5

The work describes a general study of the effects of so-called stuck-at faults on the structural and functional characteristics of combinational logic networks. It is shown that some of the possible faults which can occur in a given network bear relations to certain other possible faults in that network. Knowledge of these relations greatly facilitates consideration of networks in the presence of failures. The two types of relations considered are those of covering and equivalence. The covering relations introduced reflect the mechanisms whereby the presence of certain faults in a network renders the occurrence of other failures to some extent unobservable. The equivalence relations which are presented reflect the varying degrees which distinct faults in a network can be indistinguishable. A modelling technique is presented whereby the structure of a given network is represented by a labelled, directed graph. The effects of faults on this structure are modelled by appropriate transformations applied to this graph. These models and the associated algebraic techniques which are developed provide a particularly convenient means of characterizing the relations between, and other aspects of, the faults which can occur in a network. Key theorems establish necessary and sufficient conditions for the existence of the various covering and equivalence relations which permit one to determine these relations directly from a systematic inspection the network under study. Author (TAB)

N70-37994# Oak Ridge National Lab., Tenn.
PICTURE: AN AID IN DEBUGGING GEOM INPUT DATA
D. C. Irving and G. W. Morrison 14 May 1970 13 p Sponsored by AEC
(AD-706695; ORNL-TM-2892) Avail: CFSTI CSCL 9/2

Program PICTURE was written to provide aid in preparing correct input data for the general geometry routine GEOM. PICTURE provides a printed view of arbitrary two-dimensional slices through the geometry. By inspection of these pictures one may determine if the geometry specified by the input cards is indeed the desired geometry. Input specifications for PICTURE, sample problem input and program listings are all contained in the report. Author (TAB)

N70-37995# Oak Ridge National Lab., Tenn.
PLOTTER: A GENERAL-PURPOSE PLOTTING ROUTINE
D. C. Irving and H. S. Moran 22 May 1970 10 p refs Sponsored by AEC
(AD-706694; ORNL-TM-2873) Avail: CFSTI CSCL 9/2

The INTRIGUE Calcomp plotting package has been modified to make the height of the plot variable. The variable height plotting package has been incorporated in a general purpose routine, PLOTTER, controlled by input cards. This obviates the need for the user to write a main routine to call the INTRIGUE package. Author (TAB)

N70-38000# RAND Corp., Santa Monica, Calif.
A SURVEY OF DATA STRUCTURES FOR INTERACTIVE GRAPHICS
J. A. Hamilton Apr. 1970 52 p refs

(Contract DAHC15-67-C-0141)
(AD-706706; RM-6145-ARPA) Avail: CFSTI CSCL 9/2

The paper compares methods of organizing data within a computer to permit many interactive computer graphic applications. A data structure is a collection of blocks of machine words (beads) within a subset of the computers memory. A program for processing such a structure must be able to create and destroy beads and to reference data items (bit strings). The first ability is provided by LEAPS associative-memory storage allocation system. The referencing ability furnished by several procedural languages enables the programmer to design structures. However, several predesigned ring structures are useful in interactive graphics-e.g., Sketchpad or CORAL. TAB

N70-38002# IBM Watson Research Center, Yorktown Heights, N.Y.
DATA GRAPHS AND ADDRESSING SCHEMES: EXTENDED ABSTRACT
Arnold L. Rosenberg 12 Nov. 1969 39 p refs
(Contract N00014-69-C-0023)
(AD-706792; RC-2707) Avail: CFSTI CSCL 9/2

A data graph is obtained from a data structure by masking out the specific data items at the nodes of the structure and concentrating only on the linkages in the structure. This factoring operation is done implicitly when one refers to tree structures or arrays as generic objects. Structural uniformities in data graphs can often be exploited to facilitate and systematize the accessing of nodes in the graph and the implementation of the graph in a computer. The paper presents a model for data graphs which can be used to study such uniformities. The main results reported characterize, in terms of structural uniformities, those classes of data graphs which can be implemented by relative addressing and by relocatable relative addressing. Author (TAB)

N70-38003# IBM Watson Research Center, Yorktown Heights, N.Y.
DATA GRAPHS AND ADDRESSING SCHEMES
Arnold L. Rosenberg 8 Jan. 1970 74 p refs
(Contract N00014-69-C-0023)
(AD-706789; RC-2747) Avail: CFSTI CSCL 9/2

A data graph is obtained from a data structure by masking out the specific data items at the nodes of the structure and concentrating only on the linkages in the structure. This factoring operation is done implicitly when one refers to tree structures or arrays as generic objects. Structural uniformities in data graphs can often be exploited to facilitate and systematize the accessing of nodes in the graph and the implementation of the graph in a computer. The paper presents a model for data graphs which can be used to study such uniformities. The work reported herein represents the initial phase of an investigation of this model; the emphasis is on obtaining precise formulations of relevant uniformities and investigating their mathematical consequences. In particular, the notions of implementation by relative addressing and relocatable implementation are introduced, and the classes of data graphs which can be so implemented are characterized. Author (TAB)

N70-38028# Gt. Brit. National Inst. for Research In Nuclear Science, Chilton. Computer Applications Group.
COMPUTER GRAPHICS PATCHING OF HPD FAILED EVENTS
D. B. Scott Jan. 1970 24 p refs
(RHEL/R-190) Avail: AEC Depository Libraries

A system of programs is described for the rescue of bubble chamber events which, having been measured on the automatic Hough Powell Device (HPD), subsequently fail in the geometrical reconstruction of the event from its three views. Selected regions of the events are displayed on a computer-controlled CRT, and faults in the pattern recognition process of track-finding repaired by an operator using a light-pen. The results are subsequently merged with the good events onto a new geometry-input magnetic tape. Author (NSA)

N70-38045# RAND Corp., Santa Monica, Calif.
THE GRAIL RING STRUCTURE AND PRIMITIVES
T. O. Ellis, J. F. Heafner, and W. L. Sibley Apr. 1970 40 p refs
(Contract DAHC15-67-C-0141)
(AD-706715; RM-6241-ARPA) Avail: CFSTI CSCL 9/2

The paper gives a description of the ring-structure mechanism that controls the disposition of data and storage space in the GRAIL system. The ring structures--continuous chains of elements containing codes and either links or data--represent the logic of both the users program and of the system itself. The basic types are (1) system structure; (2) files description structure; (3) file structure; (4) context structure; and (5) plane structure. Common to the first three types is a space allocation substructure that describes the location of data sets within a particular area in secondary storage and of space available for use. Basic operations on ring structures--such as finding, procuring, and releasing elements--are performed by ring structure primitives, written as a group of remote code sequences. Author (TAB)

N70-38056# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
BLISS REFERENCE MANUAL: A BASIC LANGUAGE FOR IMPLEMENTATION OF SYSTEM SOFTWARE FOR THE PDP-10
W. A. Wulf, D. Russell, A. N. Habermann, C. Geschke, G. Apperson et al 15 Jan. 1970 65 p
(Contract F44620-67-C-0058)
(AD-706108; AFOSR-70-1303TR) Avail: CFSTI CSCL 9/2

The document describes the BLISS implementation language as written for the PDP-10. BLISS is a language specifically designed for use as a tool in implementing large software programs. Special attention is given in the language design to the requirements of the systems programming task, such as: space and time efficiency, the representation of data structures, the lack of run-time support facilities, flexible control structures, modularization, and parameterization of programs. TAB

N70-38069# Colorado State Univ., Fort Collins. Dept. of Statistics.
ON THE OPTIMAL TWO-RESPONSE DESIGNS OF THE CYCLIC PBIB DESIGN
J. N. Srivastava and L. I. McDonald Wright-Patterson AFB, Ohio ARL Feb. 1970 26 p refs
(Contract F33615-67-C-1436)
(AD-706389; ARL-70-0022) Avail: CFSTI CSCL 14/2

A certain class delta of two-response cyclic PBIB designs is considered where for any design D is an element of delta, there may exist experimental units on which not both responses are measured. Allowing for the possibility that the responses may have different costs of measurements it is shown that (with respect to the trace criterion and subject to a restriction on the total cost of the experiment) there is a large class of situations where the optimum design in delta is not the standard multiresponse design (i.e. the design in which all responses are measured on every unit). It is further shown that a subclass delta* of delta called the hierarchical multiresponse designs, is complete in the sense that given D is an element of delta there is a design D* is an element of delta* such that D* is at least as good as D with respect to both the trace criterion and the cost. The problem (a nonlinear integral valued programming problem) of obtaining the best design from delta is considered and finally tables are given which enable one to easily obtain this optimum design in any given situation. Author (TAB)

N70-38071# Allied Research Associates, Inc., Concord, Mass.
INTERNATIONAL BIBLIOGRAPHY OF PICTORIAL PATTERN RECOGNITION
Jacques J. O. Palgen Apr. 1970 123 p refs
Avail: CFSTI

The bibliography was prepared on punched cards, with entries for authors, titles, editors, and separator cards. A subject-related taxonomic index is to be included in subsequent editions. The data is available on magnetic tape to qualified users. R.B.

N70-38078# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
ON THE ROLE OF THE DIGITAL COMPUTER IN THE DETERMINATION OF PHARMACOKINETIC PARAMETERS
Richard Bellman May 1969 11 p refs
(Grant NIH GM-16197-01)
(USCEE-355) Avail: Issuing Activity

The question of establishing the existence of various parameters and the use of computed results to determine feasible and optimal drug regimens are briefly discussed, including mathematical modelling, computational solution of complex equations, and simulation. The identification of systems is then considered. Explanations are given concerning application of quasilinearization theory to studying identification processes, and to the use of an alternate approach. P.A.B.

N70-38085 Catholic Univ. of America, Washington, D.C.
SEQUENTIAL DECODING OF CHANNELS WITH DEPENDENT ERRORS
Philip Anthony Tenkhoff (Ph.D. Thesis) 1969 203 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-18581

The effect of a short burst of errors on the number of computations required to decode the input sequence is analyzed. An upper bound to the mean number of computations is derived and compared to experimental results. Computer simulations which show the distribution of computations are presented. An analytical approach which considers the decoder tree search procedure as a random walk problem is developed. The increase in undetected errors caused by dependent input errors is analyzed; experimental results are shown and compared to the analyses. The dependent error channel is modeled by two separate Markov processes and the computational cutoff rate is calculated. Comparisons with channel capacity and with memoryless channels possessing the same average probability of error are presented. Some approaches to overcoming the adverse effect of burst errors are shown. In particular, interleaving and concatenation with algebraic codes are considered. Dissert. Abstr.

N70-38087# California Univ., Berkeley. Electronics Research Lab.
A COMMAND STRUCTURE FOR INTERACTIVE PROGRAMMING
Remi F. Despres 24 Mar. 1969 117 p refs
(Contract ARPA SD-185)
(AD-707359; P-17) Avail: CFSTI CSCL 9/2

From a language design and implementation point of view the class of interactive programming systems introduces the problem of symbolic program modification at run time. Two main approaches have been used to solve this new problem. The first is the technique of incremental compilation where a source program is decomposed into statements and is compiled statementwise (JOSS, QUIKTRAN, etc.). The second approach, which we will call symbolic self-modifiability is well exemplified by LISP and consists of defining a programming language together with an internal representation for it in terms of objects that programs themselves can manipulate. The dissertation presents an attempt at designing a command structure, in the sense of IPL VI, such that symbolic self-modifiability is possible for a large class of languages, yet with a reasonable execution speed. TAB

N70-38098# California Univ., Berkeley.
KDF REFERENCE MANUAL
P. Deutsch 1969 16 p
(AD-707344; SD-185) Avail: CFSTI CSCL 9/2

KDF is the subsystem which implements permanent disk files. It operates entirely outside of the TSS file-naming system; as a consequence, KDF files must be copied to scratch files before they can be accessed by the exec or by subsystems. Aside from this restriction, KDF provides most of the facilities of the scratch file system: symbolic names, public, private, and password access, and directory listing. TAB

N70-38153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC 'JACKS OF ALL TRADES': PREDICTIONS IN SCIENCE
O. Gusev 27 Jan. 1970 8 p Transl. into ENGLISH from Pravda (Moscow), 4 Jan. 1970 p 3
(AD-708776; FTD-HT-23-57-70) Avail: CFSTI CSCL 9/2

The document comments on the proliferation of electronic computers during the upcoming decade and the prospects for their use in the foreseeable future. TAB

N70-38204# International Business Machines Corp., San Jose, Calif. Research Lab.
FILE DESIGN: A PRACTICAL APPROACH. VOLUME 1: FILE DESIGN HANDBOOK Final Report
Michael E. Senko and Harriet R. Meadow Oct. 1969 237 p
(Contract F30602-69-C-0100)
(AD-707155; RADC-TR-69-392-Vol-1) Avail: CFSTI CSCL 9/2

The prototype file design handbook contains extensive quantitative file design discussion. The basic foundation of the discussion is provided by tables and graphs derived from hundreds of actual machine and simulation model runs. These runs take into consideration all the complex characteristics of real-life access methods and thereby insure against oversimplified abstractions which tend to overestimate performance. The file designer can use these tables to obtain quantitative estimates of performance for analogies to his problem and to obtain general information with regard to trends and discontinuities in access method behavior. The text contains discussions of generalizations that appear to be validly derivable from the tables. Finally, in several instances, approximate equations have been provided to further quantify the generalizations for the designer. Author (TAB)

N70-38241# Naval Research Lab., Washington, D.C. Research Computation Center.
THE 3800 COMPUTER DRUM RANDOM ACCESS I/O SUBROUTINES Final Report
Doris E. Gossett, Douglas P. Shannon, and Sylvia L. Syphax May 1970 18 p
(AD-707337; NRL-MR-2128; NRL-Computer-Bull-14) Avail: CFSTI CSCL 9/2

Four subroutines have been written in COMPASS for the 3800 computer to allow handling of drum random access units from within Fortran programs. These subroutines perform the functions of positioning the drum, reading, writing, and determining the unit length for drum random access units. Author (TAB)

N70-38300# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).

AN ITERATIVE CHAIN PROGRAM SYSTEM FOR SPECTRUM ANALYSIS BY THE PDP-9 [EIN INTERPRETATIVES TEILPROGRAMMSYSTEM ZUR SPEKTRENBEARBEITUNG AUF DER PDP-9]

W. Busse, R. Michaelsen, and R. Schintke Jul. 1970 86 p In GERMAN

(HMI-B-94; B-NDV3) Avail: CFSTI

The described interpretive computer program for spectrum evaluation is applicable to input-output routines and data reduction by the PDI-9 computer. The system is subdivided into chain segments that are fed into the memory at command. Transl. by G.G.

N70-38305# Electro-Mechanics Co., Austin, Tex.

A MODIFIED DATA ASSIMILATOR, DIGITIZER AND ANALYZER FOR USE WITH VARIABLE-AREA FILM SWEEP-SCAN READER Final Report, 13 Feb. 1969 - 16 Apr. 1970

Arthur L. Bryant and Fred J. Morris 16 Apr. 1970 99 p

(Contract F19628-69-C-0217)

(AD-707536; AFCRL-70-0234) Avail: CFSTI CSCL 9/2

The variations in the earths magnetic field may be recorded by any one of several methods. The methods of interest in the present report is the photographic recording method which produces a variable-area film record known as the Vestine-Chernosky magnetogram. Records of this type may be evaluated by the use of photoelectric reading devices. The output of the reading device can be fed into electronic equipment that will assimilate, digitize and analyze the data. The report describes the modifications to the existing electronic system which analyzes variable-area magnetograms and provides a magnetic tape recording of the analysis. Author (TAB)

N70-38310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STANDARDIZED SERIES OF CONVERTERS

G. V. Moskalenko et al 1 Apr. 1970 16 p refs Transl. into ENGLISH from Mashinostroyeniye (Moscow), 1968 p 226-233

(AD-706209; FTD-MT-24-45-70) Avail: CFSTI CSCL 9/2

The development of three digital to analog converters and three analog to digital converters is announced. TAB

N70-38322# Air Force Cambridge Research Labs., Bedford, Mass.

LOCAL OPERATIONS IN A PARALLEL PICTURE PROCESSING ARRAY

Hans H. Zschirnt Apr. 1970 28 p refs *Its* Phys. Sciences Res. Papers No. 415

(AD-707093; AFCRL-70-0208) Avail: CFSTI CSCL 9/2

A picture pre-processor has been proposed which translates, at high speed, pictorial inputs, particularly black-on-white drawings, into suitable inputs for automated pattern recognition and/or scene analysis systems. The core of the system is an array of programmed logic cells onto which the input picture is projected. By appropriate local logic operations executed simultaneously by all the logic cells on the outputs of the cells adjacent to them, topologically significant features of the input picture are extracted. The instruction repertoire of the cells and instruction sequences accomplishing this feature extraction are described and examples obtained by simulation are given. Author (TAB)

N70-38337# Rand Corp., Santa Monica, Calif.

THE MIND SYSTEM: A GRAMMAR-RULE LANGUAGE

Ronald M. Kaplan Apr. 1970 79 p refs

(Contract F44620-67-C-0045)

(AD-706409; RM-6265/1-PR) Avail: CFSTI CSCL 9/2

The paper gives a description of the MIND Grammar-Rule Language (MGRL), including parsing procedure and grammar rules. MGRL is the formalism for the grammar input to the MIND syntactic analysis component, currently being programmed for the IBM 360/65. MIND (Management of Information through Natural Discourse) is a system consisting of nested and chained modules of high-level programming language statements designed to meet the need for fast and accurate information transactions between senior command, control, and policymaking personnel of the Air Force and other services, and large, heterogeneous, loosely formatted information banks. Author (TAB)

N70-38344# Allied Research Associates, Inc., Concord, Mass.

IMPLEMENTATION OF A PROTOTYPE DATA RETRIEVAL SYSTEM FOR LITERATURE ON BIOLOGICAL EFFECTS OF RADIOFREQUENCY FIELDS, SUMMARY REPORT Final Report

Janet Healer and Robert Smiley Dec. 1969 27 p refs

(Contract DADA17-69-C-9021)

(AD-706851; ARA-9G61F-Vol-1) Avail: CFSTI CSCL 5/2

A prototype information-handling and retrieval system designed in a previous program for literature in the subject field of biological effects of radio frequency radiations was implemented and evaluated in preliminary tests. This system makes the information base accessible on the basis of its technical and bibliographic data content elements. These elements are represented within the system according to a specially designed data classification and encoding scheme. For initial operation and testing purposes the system was implemented using simple card-handling equipment. Various operating alternatives were explored from semi-automated to large-scale digital computing and time-share systems. The prototype system was found to be conveniently adaptable to these alternate modes of operation. The feasibility of the prototype system and its design principles have been demonstrated and the system appears suitable for practical applications. Author (TAB)

N70-38360# California Univ., Berkeley.

CONDITIONAL CONVERSATIONAL COMMAND PROCESSING

Charles A. Grant 1 May 1969 19 p refs Sponsored in part by ARPA

(AD-707356; P-14) Avail: CFSTI CSCL 9/2

A general programming facility is proposed for communication with the interactive command languages of time-sharing systems in an attempt to overcome some of the current limitations of data exchange between man and machine. Commands may be constructed in an arbitrary way in a string processing language and then processed as if typed to a console by a user. The output resulting from the sent commands may be dissected and examined to determine subsequent action. A set of functions to accomplish the above which could be embedded into any string processing language is suggested, and necessary information pertinent to implementation of the facility on existing time-sharing systems is given. Author (TAB)

N70-38361# California Univ., Berkeley.

AN ALGORITHM FOR SWAPPING DATA FROM DRUM TO CORE

Van Tuyl and Robert Reed 1969 47 p refs

(Contract ARPA SD-185)

(AD-707358; P-16) Avail: CFSTI CSCL 9/2

Because of its great cost, it is important to use a computer as efficiently as possible. Unfortunately, running programs frequently block due to some slower element of the system, as, for example, a card reader or a magnetic tape unit. Rather than permit the machine to sit idle in such instances, it is common practice to halt computation entirely for a period on the blocked program and initiate a new computation. Since the latter program may be also subject to blocking, it becomes reasonable to have available a small collection of programs among which the computer processes

as determined by the blocking phenomenon and thus is kept continually busy. It is not economically feasible to equip such a machine with sufficient high - speed memory to hold the number of programs in such a set. Most of the programs must be kept in a secondary (and cheaper) memory and must be brought into high - speed memory at the appropriate time. The paper will consider the problem of managing the transfers of programs between the primary (core) and secondary (drum) memories of a system which has a moderate size core memory, a large drum, and a processor. TAB

N70-38372# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A PROGRAM VERIFIER
James Cornelius King (Ph.D. Thesis) Sep. 1969 263 p refs
(Contract F44620-67-C-0058)
(AD-699248; AFOSR-70-0039TR) Avail: CFSTI CSCL 9/2

The paper reports research toward developing a verifying compiler. Such a compiler, as well as doing the standard translation of a program to machine executable form, attempts to prove that the program is correct. In order to do this, a program must be annotated with propositions in a mathematical notation which define the correct relations among the program variables. The verifying compiler then checks for consistency between the program and its propositions. The thesis presents the theoretical basis of the method and then describes a prototype verifier in detail. This verifier, running on an IBM 360, operates on programs written in a simple programming language for integer arithmetic. Many programs have been automatically verified by this program. These include a simple sort program, a program which examines a number for the property prime, and a rather subtle program which raises an integer to an integral power. The formal analysis of a program produced verification conditions which must be proven to be theorems over integers. The verifier proves these theorems by using powerful formula simplification routines and specialized techniques for integer expressions. Ideas for improving this verifier and for building one which will operate on a more complicated programming language are also presented. Author (TAB)

N70-38399# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
PROGRAMMABLE CELLULAR LOGIC ARRAYS
Richard G. Shoup Mar. 1970 242 p
(Contract F44620-67-C-0058)
(AD-706891; AFOSR-70-1550TR) Avail: CFSTI CSCL 9/2

In recent years, technological advances have provided the designer of computing hardware with the ability to batch-fabricate large numbers of logic components on a single semiconductor slice. Numerous researchers have investigated the synthesis of various kinds of digital logic by using arrays of identical cells. The dissertation considers cellular arrays whose individual cell functions are determined by parameter flip-flops and logic gates in the cell, rather than by a physical customizing operation during manufacture. Potential advantages of this technique include functional variability after manufacture, more efficient testing, and enhanced failure tolerance. Arrays may be classified according to their generality, i.e., the number and range of the tasks which they are designed to perform. Two significantly different examples of low-generality arrays are presented and analyzed. A new cell schema is introduced which exhibits properties important in the synthesis of high-generality functions. Techniques are presented for improving the match between an array design and the target class of tasks. Author (TAB)

N70-38447# Informatics, Inc., Bethesda, Md.
ON-LINE RETRIEVAL Final Technical Report, 1 Aug. 1969 - 23 Feb. 1970
Thomas C. Lowe and David C. Roberts Griffiss AFB, N.Y. RADC Apr. 1970 208 p refs
(Contract F30602-69-C-0038)
(AD-706866; TR-69-1090-2; RADC-TR-70-44) Avail: CFSTI CSCL 5/2

The report is concerned with the implementation of an on-line information storage and retrieval system for the Rome Air Development Center. This system is to incorporate techniques of automatic document classification for a large document collection in an interactive environment. Following a review of the system design, the implementation of the system executive is described in detail. Because this executive program also governs communications between the user and the system, it must be a communications package, a training aid, a file building program, and an executive program all in one. Author (TAB)

N70-38560# Michigan Univ., Ann Arbor.
MODIFICATIONS TO THE SEL EXECUTIVE SYSTEM
James H. Jackson and James F. Blinn Feb. 1970 14 p ref
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-706104; Memo-25) Avail: CFSTI CSCL 9/2

Some modifications to the SEL Executive System are described which improve the performance of the system, but which do not change the set of system subroutines, the entry point to any system subrountine, or the calling sequence for any system subroutine. User programs which run with the original version of the system need not be changed in order to run with the new version of the system. Author (TAB)

N70-38589# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON INTERFACING A DIGITAL COMPUTER WITH A STRUCTURALLY UNIFORM LOGIC UNIT
A. P. Vishnevskii 20 Jan. 1970 15 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 26, 1967 p 57 - 65
(AD-706199; FTD-MT-24-388-69) Avail: CFSTI CSCL 9/2

Some problems of designing interface systems for computers are discussed. Such interface systems are necessary to match the input/output logic codes and levels of the computer to those of the system which operates in conjunction with the computer. One variant of such an interface designed for operation with the computer Dnepr is discussed. TAB

N70-38619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEANS OF ANALOG AND ANALOG-DIGITAL TECHNOLOGY Selected Articles
E. A. Erokhin et al 28 Apr. 1970 33 p refs Transl. into ENGLISH of the publ. 'Sredstva Analogovoy i Analogo-Tsifrovoy Vychislitelnoy Tekhniki' Moscow, Izd. Mashinostr., 1968 p 74 - 86; 161 - 165
(AD-707183; FTD-MT-24-42-70) Avail: CFSTI CSCL 9/2

Contents: Equipment of automatic optimization and its application jointly with an analog computer, and Modernization of blocks and devices of the MN-14 analog calculating machine and the set of NBN-1 nonlinear blocks. TAB

N70-38667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SPECIAL-PURPOSE DIGITAL MACHINE BASED ON THE PRINCIPLE OF LINEAR-CIRCULAR INTERPOLATION AND INTENDED FOR CONTINUOUS PROGRAM CONTROL OF MILLING MACHINES
E. Kachinskii 20 Feb. 1970 30 p Transl. into ENGLISH from the Russian
(AD-707294; FTD-HT-23-233-69) Avail: CFSTI CSCL 9/2

The paper describes a special purpose digital computer using straight line circular interpolation for the continuous programming

control of milling machines. The paper discusses the following problems: the method of interpolation (contour and velocity); the means for path correction; the principles of programming; the technical realization of the system; and the technical specifications. The information containing elementary displacement increments (the machine tool programme) which the interpolator produces in pulse form, is processed by a digital to phase converter. The converter outputs square waves which contain the machining program in phase shift form. The square waves produced by the converter are recorded on magnetic tape. The program of the interpolator is prepared with the aid of a general purpose digital computer. The program for this was written in the Electrotechnical Institute. The structure of this programme cuts down the work of the programming technologist to a minimum. TAB

N70-38706# Mitre Corp., Bedford, Mass.

GRASP: A PL/I COMPATIBLE GRAPHICS SUBROUTINE PACKAGE FOR THE IBM 2260 DISPLAY STATION (LOCAL ATTACHMENT). VOLUME 1: INTRODUCTION AND USER'S MANUAL

Richard H. Bullen, Jr. May 1970 34 p refs

(Contract F19628-68-C-0365)

(AD-706133; MTR-1768-Vol-1; ESD-TR-70-124-Vol-1) Avail: CFSTI CSCL 9/2

GRASP is a set of PL/I compatible subroutines which provide programming support for the IBM 2260 Display Station in local attachment; i.e., the attachment of a 2260 directly to a System/360 CPU channel via the IBM 2848 Display Control. The subroutines are coded in OS/360 Assembler Language and are reentrant. They permit the PL/I programmer to manipulate the 2260 as an I/O device in the same manner available to the Assembler Language programmer using the Graphics Access Method under OS/360 (with restrictions as noted in the Introduction to Volume I of the document). All errors, except those which normally result in OS/360 abnormal ends (ABENDS), are returned to the user via subroutine parameters. GRASP is designed to operate under the MFT configuration of OS/360. Volume I of the document gives an overview of the 2260 and an introduction to the GRASP routines. Volume II gives detailed program specifications. Author (TAB)

N70-38707# Mitre Corp., Bedford, Mass.

GRASP: A PL/I COMPATIBLE GRAPHICS SUBROUTINE PACKAGE FOR THE IBM 2260 DISPLAY STATION (LOCAL ATTACHMENT). VOLUME 2: PROGRAM SPECIFICATIONS

Richard H. Bullen, Jr. May 1970 28 p

(Contract F19628-68-C-0365)

(AD-706134; MTR-1768-Vol-2; ESD-TR-70-124-Vol-2) Avail: CFSTI CSCL 9/2

For abstract see N70-38706

N70-38754# California Univ., Berkeley. Electronics Research Lab.

AN INFORMATION RETRIEVAL SYSTEM BASED ON SUPERIMPOSED CODING

John R. Files and Harry D. Huskey 10 Jul. 1969 28 p refs

(Contract ARPA SD-185)

(AD-707360; P-20) Avail: CFSTI CSCL 5/2

A method of coding a large file for information retrieval is discussed. Random superimposed coding of machine derived roots of the full vocabulary is used to generate an easily updatable and very compact code file. No thesaurus or dictionary of terms is needed. High speed is made possible by the simplicity of the searching algorithm as well as the ability to make a search for several key words simultaneously. The simplicity of the search facilitates implementation of the system on a small computer with access to a large bulk storage device. Author (TAB)

N70-38757# California Univ., Santa Barbara.

RESEARCH ON APPLICATION OF ON-LINE COMPUTATIONS Final Technical Report, 1 May 31 Oct. 1969

Roger C. Wood and Glen J. Culler 31 Jan. 1969 32 p refs

(Contract Nonr-4222(09))

(AD-707094; UCSB-CRL-9) Avail: CFSTI CSCL 9/2

The document is the final technical report which describes progress in developing the algebraically oriented language, and advances in techniques for correcting Helium speech. Both projects terminate with the potential for further fruitful research. Author (TAB)

N70-38767# California Univ., Berkeley. Electronics Research Lab.

AN INTERACTIVE INFORMATION ORGANIZATION AND RETRIEVAL SYSTEM IN A TIME-SHARING ENVIRONMENT

Mehdi Baghebanzadeh Kermani (Ph.D. Thesis) Jun. 1969 103 p refs

(Contract ARPA SD-185)

(AD-707361; P-21) Avail: CFSTI CSCL 9/2

The study of the formatted file organization and retrieval systems, in particular, the scatter indexing methods, were the major part of the formatted systems which are investigated. The upper bound of such an index file using single and multiple attribute queries is studied and obtained. In the general file systems, the study begins with the investigation of some of the existing systems, leads to some possible improvement observations, and finally results in the projection-angle (PRANG) clustering technique. This method of clustering partitions the process into two individual processes and associates records according to joint similarity and simultaneously makes it easier to locate the proper cluster in the retrieval phase. An operating system for this method using the TSS 940 time-sharing computer system at the Berkeley campus is implemented and the results of such a system for two data bases are studied. The Prang system is able to produce clusters for such data bases and thus organize proper information retrieval systems. The retrieval of the system results in orderly related records of the file with an associating factor for the retrieved records. Author (TAB)

N70-38771# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.

NUMERICAL-GEOMETRICAL TECHNIQUES FOR INFORMATION STORAGE AND RETRIEVAL Interim Report

C. Lindgren and S. Ernesto 1 Oct. 1969 11 p *Its* Paper No. 30

(Contract N00014-67-A-0298-0004)

(AD-707188; ONR-TR-30) Avail: CFSTI CSCL 9/2

When a surface is such that its mathematics is intractable, storage and later retrieval for further operations and transformations with it require the storage and retrieval of the three coordinates characterizing each point in space. Some numerical-geometrical techniques are suggested in this paper in an attempt to reduce the number of locations required for storing information related to the surface. Author (TAB)

N70-38789* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REAL-TIME DIGITAL-COMPUTER-HARDWARE SIMULATION OF A SPACECRAFT WITH CONTROL-MOMENT-GYROSCOPE STABILIZATION

Claude R. Keckler, Robert G. Kyle, Ralph W. Will, and Charles T. Woolley Washington Sep. 1970 53 p refs

(NASA-TM-X-2069; L-6555) Avail: CFSTI CSCL 09B

A description of a real-time digital computer hardware simulation of an Apollo Telescope Mount (ATM) mission is presented. The simulation was employed to evaluate the performance of a

full-scale control moment gyroscope (CMG) system in providing stabilization for the ATM cluster. For this evaluation, a full-scale CMG system is linked to a real-time digital computer program representing the ATM cluster. The program consists of the spacecraft rigid and flexible body dynamics, internal and external disturbances, and the baseline CMG system momentum-feedback control law with isogonal correction. System stability and limit cycling problems were encountered during initial operations. The problems are discussed and possible solutions are outlined. Author

N70-38792# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALOG COMPUTER: SPECIALIZED FOR PROCESSING THE RESULTS OF MEASUREMENTS
V. I. Katashkin et al 27 Mar. 1970 11 p refs Transl. into ENGLISH from the book 'Sredstva Analogovoy i Analogo-Tsifrovoy Vychislitelnoy Tekhniki' Moscow, Izd-Vo Mashinostroyeniye, 1968 p 97-100
(AD-706207; FTD-MT-24-29-70) Avail: CFSTI CSCL 9/2

General ideas underlying the design of special-purpose analog computers are set forth. A principle of simplified-to-suit-specified-accuracy equipment was used in the development of a special analog computer (SAC) for statistically processing the results of measurement of deformations of automobile tires. Three axial deformations measured by strain gages on a running tire (and converted into voltages) were recorded on magnetic tape. These measurements were applied to the SAC which calculated two principal deformations and two stresses. All 7 parameters were fed to a multichannel amplitude analyzer which determined the distributions of their maxima, minima, and spread over 1000 revolutions of the tire. The SAC comprises 15 operational amplifiers and one nonlinear unit; its overall error is 3 percent. Each SAC unit has a gain of 250 at zero frequency and a reduced-to-grid zero-point drift of 3 mv for 30 min; a passband for a 100-v sinusoidal signal is 65 kHz. Author (TAB)

N70-38828# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION SCIENTIFIC RESEARCH INSTITUTE OF ELECTRICAL POWER ENGINEERING. TRANSACTIONS, NO. 27, 1967: SELECTED ARTICLES
S. A. Ginzburg et al 30 Jan. 1970 56 p refs Transl. into ENGLISH from Vsesoyuznyi Nauchn. Issled. Inst. Elektroenergetiki Tr. (USSR), no. 27 56 p
(AD-706200; FTD-MT-24-407-69) Avail: CFSTI CSCL 9/2

Contents: Construction of circuits of the RER-2 computer; Multichannel analog memory; A program control unit for the RER-2 computer; Peripheral equipment of the Rer-2 computer. TAB

N70-38849+ British Broadcasting Corp., Kingswood (England). Research Dept.
PULSE CODE MODULATION OF VIDEO SIGNALS: 8-BIT CODER AND DECODER
1970 13 p refs
(Rept-1970/25) Avail: CFSTI

Equipment is described which was constructed for converting analogue television signals into 8-bit p.c.m. signals and vice versa. The conversion rate used for video signals is approximately 13 million samples per second. Analogue-to-digital conversion is accomplished by two consecutive 4-bit parallel converters. The design of the digital-to-analogue converter is more conventional and employs a binary ladder network to weight the difits in the required manner. The extensive use of readily available integrated circuits has resulted in equipment which is compact, reliable and relatively cheap to manufacture. The peak-to-peak signal to quantising noise ratio caused by the combined coding and decoding process was found to be 57 dB as opposed to 59 dB for a perfect 8-bit system. Author

N70-38906 Carnegie-Mellon Univ., Pittsburgh, Pa.
A GOAL-ORIENTED LANGUAGE FOR THE COMPUTER
Harry Earl Pople, Jr. (Ph.D. Thesis) 1969 127 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-18591

It is proposed that the duality of syntax and semantics, as these terms relate to a modal extension of type theory, provides a dual representation in which both describe and model various aspects of a problem solving, decision making, or game playing task environment. In order to determine the implications of this proposal, we have devised a computer language, called GOL, with syntax and semantics designed to reflect this duality. Our experience with this new computational facility has shown that both descriptive and model problem solvers may be represented effectively in the expressions and data structures of the system, and that the heuristic search strategies of a variety of problem solving schemes may be emulated by the associated evaluation processes. Dissert. Abstr.

N70-38950*# Intermetrics, Inc., Cambridge, Mass.
REQUIREMENTS ANALYSIS FOR A MANNED SPACEFLIGHT PROGRAMMING LANGUAGE AND COMPILER
[1969] 48 p
(Contract NAS9-10542)
(NASA-CR-108634; MSC-01845) Avail: CFSTI CSCL 09B

A description of the functional, general, and specific requirements for a manned space flight programming language and compiler is presented with a description of the principal needs of and important considerations for manned space flight software development and application. The scope and orientation of the language are covered with lists of the functional areas and associated implied language characteristics. Some of the key problems in developing software for manned space flight projects are discussed including: software, reliability, communication and documentation, fixed point arithmetic and code optimization, software management and control, and application language. A list of general goals and guidelines for the language and compiler design is presented. A discussion is included of the specific features required in the language such as form, data and description, operations, and executable statements. The important technical features and capabilities required in the compiler are outlined, such as diagnostics, documentation and output, environmental considerations, debugging aids, macros, and optimization. Author

N70-38955*# Wolf Research and Development Corp., Bedford, Mass.
ON-LINE PROGRAMMING SYSTEM
Washington NASA Sep. 1970 57 p refs
(Contract NAS5-9756-149)
(NASA-CR-1647) Avail: CFSTI CSCL 09B

A simulation model of a system for on-line assembly language programming of the Univac 1108, utilizing the IDIIOM display, developed. The partially-implemented design is an experimental system for testing techniques of interactive programming. The study phase of this effort included the investigation of aspects of man-machine interaction wherein reduction in program development time can be realized. In the implementation of the simulation model on a time shared system certain conclusions were drawn relative to the human factors aspects which bear upon the eventual design of an on-line programming system. The work produced refinements in the design of such a system and led to the conclusion that the value of interactive techniques for computer program checkout or tracing, and for programmer teaching are far greater than for merely the coding of computer programs. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-37662# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MUTUAL ADMITTANCE FOR AXIAL RECTANGULAR SLOTS IN A LARGE CONDUCTING CYLINDER, JULY 1969 -JANUARY 1970
Gordon E. Stewart and Kurt E. Golden 1 Apr. 1970 19 p refs
(Contract F04701-69-C-0066)
(AD-706385; TR-0066(5220-10)-4; SAMSO-TR-70-173) Avail: CFSTI CSCL 9/5

An asymptotic expression is derived for the mutual admittance between axial rectangular slots on a large conducting cylinder. The isolation between slots determined from this mutual admittance approximation is compared with that obtained using the admittance from direct numerical integration and with experimental results for a cylinder in free space and in the presence of a simulated thin plasma sheath. Author (TAB)

N70-37678# Stanford Univ., Calif. High Energy Physics Lab.
SUPERCONDUCTING Nb TM SUB 010 MODE ELECTRON BEAM WELDED CAVITIES
J. P. Turneaure and Nguyen Tuong Viet Oct. 1969 12 p refs
(Contract Nonr-225(67))
(AD-707046; SU-HEPL-612) Avail: CFSTI CSCL 9/1

A number of electron-beam welded TM sub (010) mode superconducting Nb cavities were fabricated and tested at 8.6 GHz and 1.25 degrees K. These cavities were electron beam (EB) welded to avoid the difficulties of machining cavities without joints and to determine the usefulness of EB welding as a fabrication technique. Measurements demonstrate that high fields and unloaded Qs (Q sub 0)s can be obtained with these EB welded cavities. Not only has a useful fabrication technique been demonstrated, but significant increases in the fields and (Q sub 0)s, compared with earlier measurements, have been observed. Author (TAB)

N70-37697# Massachusetts Inst. of Tech., Cambridge.
STABILITY AND OPTIMIZATION OF ELECTRONIC CIRCUITS Final Report, 1 Apr. 1968 - 31 Mar. 1970
Jan C. Willems 31 Mar. 1970 9 p
(Contract DAHC04-68-C-0026)
(AD-706907; AROD-7285-10-E) Avail: CFSTI CSCL 9/5

One objective of the program was to carefully formulate the simplest models which can account for the essential features of DC-to-DC voltage converters, frequency converters, etc., and to investigate what approximations can be made to simplify calculations with these models. The second objective is to determine to what extent the optimization and stability ideas which have recently become the basic tools of control theorists, can be used to improve efficiencies, switching times, etc., in electronic designs. Author (TAB)

N70-37748# Army Electronics Command, Fort Monmouth, N.J.
A FAST 3-MILLIMETER FERRITE SWITCH
Richard A. Stern Apr. 1970 19 p refs
(AD-707411; ECOM-3264) Avail: CFSTI CSCL 9/1

A tetrahedral waveguide junction type of switch was developed for use in the millimeter region. The design employs a permanent magnet such that the switch operates in the transmission state without any external dc power. By applying a current pulse it switches from the transmission state to the reflective state in 400 nanoseconds and back to the transmission state in less than 200 nanoseconds. Over the frequency range of 95.5 to 97.2 GHz the switch exhibits an insertion loss of 1.0 dB maximum and a minimum isolation of 25 dB. Author (TAB)

N70-37749# Army Electronics Command, Fort Monmouth, N.J.
SPECTRAL DIGITAL FREQUENCY SYNTHESIZER
Dieter R. Lohrmann and Arthur R. Sills Apr. 1970 41 p refs
(AD-707425; ECOM-3265) Avail: CFSTI CSCL 9/5

A new type of digital frequency synthesizer for communications transceivers in the VHF range from 30...76 MHz, providing 920 channels with 50 kHz spacing was designed, breadboarded, tested, and packaged. Wide use of integrated circuits was made. With this new principle, very low power consumption is achieved, typically 40 mW for the synthesizer (excluding the variable frequency oscillator and buffer amplifier). Dimensions (excluding frequency control knobs): 1 in. X 1 1/4in. X 1 1/2 in. The circuit makes wide use of complementary FET-integrated circuits. The technology used for packaging is Thick Film. Author (TAB)

N70-37764# Aerospace Corp., El Segundo, Calif. Office for Technology.
ELECTRICAL CHARACTERISTICS OF A HARDENABLE, CIRCULARLY POLARIZED METALLIC LENS ANTENNA, JULY 1968 -JUNE 1969
Howard E. King, Jimmy L. Wong, Robert B. Dybdal, and Michel E. Schwartz 30 Jan. 1970 87 p refs
(Contract F04701-69-C-0066)
(AD-706882; TR-0066(5320)-4; SAMSO-TR-70-162) Avail: CFSTI CSCL 9/5

A lens antenna consisting of a circular matrix of square waveguides was proposed as a potential candidate for the hardened ground antenna in a satellite-ground communication link. Square waveguides were used for supporting circular polarization, which was found most effective in satellite-ground communication links. The purpose of the present study was to investigate unknown electrical characteristics and determine some of the important electrical properties of a 3-ft-diam scaled model antenna. The lens was designed for operation at 10 GHz with an equivalent index of refraction of 0.5. Antenna efficiency and other electrical parameters, such as radiation patterns, gain, bandwidth, scan capability, and VSWR, were investigated. The on-axis characteristics were determined over a 10% frequency range. The antenna efficiency varied from 38 to 43.5%, and sidelobe levels were at least 20 dB below the main beam over this frequency range. Different feed horn sizes were employed to obtain an optimum aperture illumination. Antenna characteristics were determined for various beam scan angles to 21.5 degrees or 9.1 beamwidths. For a 3-dB drop in gain, the antenna beam can be steered to an angle of 18 degrees or 7.65 beamwidths. The deterioration in antenna performance with scan is also shown. Some preliminary results are presented for lens performance as affected by a feed enclosure back plate and an aperture blockage. Author (TAB)

N70-37882# Army Electronics Command, Fort Monmouth, N.J.
OUTPUT AND POLYNOMIAL CHARACTERISTICS OF A NONLINEAR SERVICE
Nello R. Castellini Apr. 1970 20 p refs
(AD-706831; ECOM-3251) Avail: CFSTI CSCL 9/5

Based on the assumption that the characteristic of a non-linear device is a polynomial of degree M, the paper presents the theory for the prediction of the output of prescribed frequency under general conditions. The theory leads to an unexpected result: it provides the recipe for the determination of the polynomial coefficient by measurement. The number of measurements required is M + 1. Author (TAB)

N70-37864# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
NUMERICAL TECHNIQUES FOR FAST AND ACCURATE TRANSIENT ANALYSIS OF NONLINEAR CIRCUITS
Donald A. Calahan May 1970 18 p refs
(Grant AF-AFOSR-1217-67)
(AD-706914; AFOSR-70-1470TR) Avail: CFSTI CSCL 9/5

The field of nonlinear circuit simulation has from the beginning been plagued by numerical problems arising from the use of numerical methods not matched to the problems which simulation programs were intended to solve. These programs have, however, provided the stimulus for research in this area by electrical engineers or by engineer-mathematician teams. The result has been an enormous increase in the efficiency and reliability of experimental simulation programs. In this paper, it is shown how recent work in sparse matrix methods and numerical integration techniques have made possible analysis of gate-sized switching circuits in seconds with a medium-speed computer and in fractions of a second with high-speed models. Further, it is shown how choice of proper variables affects both the reliability and speed of solution.
Author (TAB)

N70-37892# Air Force Cambridge Research Labs., Bedford, Mass.
EVALUATION OF AN S-BAND TELEMETRY NOSE CONE ANTENNA SYSTEM
Raymond E. Wilton Apr. 1970 23 p refs *Its* Instrumentation Papers No. 165
AD-707487; AFCRL-70-0211) Avail: CFSTI CSCL 9/5

The S-band telemetry nose cone antenna system described is an inexpensive and easily constructed antenna system. This antenna has proved to be effective for use on research sounding rockets that have a reasonably stable trajectory. An analysis of the test results for this antenna system as used on an Aerobee 150 rocket at White Sands Missile Range, New Mexico, is included.
Author (TAB)

N70-37915# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
NUMERICAL CONSIDERATIONS IN THE TRANSIENT ANALYSIS AND OPTIMAL DESIGN OF NONLINEAR CIRCUITS
Donald A. Calahan May 1970 18 p refs
(Grant AF-AFOSR-1217-67)
(AD-706917; AFOSR-70-1474TR) Avail: CFSTI CSCL 9/5

Although the formulation of equations for nonlinear electrical circuits has received a great deal of attention, it is only recently that a corresponding concern with the solution phase has been evidenced. As this interest has developed, so too has a realization of the intimate numerical relationship between the formulation and solution. This concern extends to both analysis and (automatic) iterative design, for there are numerical problems which are peculiar to the generation of gradients necessary in slope-following optimization methods. This paper is a summary of this research area. To be precise, it is a survey of current progress made in solving numerical problems which arise in the formulation and solution phases of the transient analysis and iterative design of nonlinear electrical circuits. The truly remarkable progress that has been made in this field is illustrated by design of a gate-sized switching circuit.
Author (TAB)

N70-37968# Allied Research Associates, Inc., Concord, Mass.
CITATION INDEX FOR FOREIGN LANGUAGE REPORTS ON BIOLOGICAL EFFECTS OF RADIO-FREQUENCY ELECTROMAGNETIC FIELDS, VOLUME 3 Final Summary Report, 1 Aug. 1968 - 31 Jul. 1969
Janet Healer and Robert Smiley Dec. 1969 94 p refs
(Contract DADA17-69-C-9021; ARPA Order 791)
(AD-706236; ARA-9G61-F-Vol-3) Avail: CFSTI CSCL 6/18

A citation index is presented for foreign language documents selected from an extensive literature collection in the subject field of biological effects of radio-frequency electromagnetic fields, with emphasis on the microwave range. Also included is a list of references cited in each document used as a basis for the citation index.
Author (TAB)

N70-37976# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DEVELOPMENT OF A DOPPLER DATA DIGITIZER
Harvey A. La Fon, II Mar. 1970 40 p refs
(AD-706218; BRL-MR-2032) Avail: CFSTI CSCL 9/5

A Doppler data digitizer has been developed for use with Doppler missile tracking systems and dispersive Doppler ionospheric research experiments. The basic output data of such Doppler systems, which are in the form of frequencies between zero and several kilohertz, are converted to a 27 bit binary digital format. The circuit theory and development and operation of the digitizer are described in this report.
Author (TAB)

N70-37982# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
NEW ELECTRONIC SYSTEM FOR USRD ANECHOIC-TANK FACILITY Final Report
C. W. Stoops 15 May 1970 76 p ref
(AD-706332; NRL-MR-2113) Avail: CFSTI CSCL 9/3

The transducer calibration system of the Anechoic Tank Facility at USRD has been improved by replacing its original components with electronic equipment of the latest design. A precision frequency synthesizer, a unique synthesizer controller, toneburst and receive-gate generators, a receive amplifier, a peak detector, and improvements to linear and polar recorders have been installed. They are described in detail and illustrated with schematic electronic diagrams of the USRD-designed units. Integrated circuits and semiconductors have been used throughout.
Author (TAB)

N70-37983# General Electric Co., Binghamton, N.Y. Avionic Controls Dept.
BRUSHLESS DC TORQUE MOTOR DEVELOPMENT Final Report, 2 Jun. 1969 - 31 Jan. 1970
Erich W. Manteuffel, Benjamin H. Hertzendorf, Martin F. O'Connor, and David W. Pepin 31 Jan. 1970 113 p refs
(Contract F04701-69-C-0373)
(AD-707514; ACD-9849; SAMSO-TR-70-127) Avail: CFSTI CSCL 9/3

Three high-performance 7 ft-lb brushless dc torquers were designed, fabricated and tested under this contract. The torquer characteristics were specifically optimized for use as CMG gimbal actuators. The brushless dc torquers employ Hall generators to resolve rotor-position and control the currents in the two motor phases. The associated electronic controller incorporates a redundant standby channel for reliability and uses pulse width modulated power amplifiers to achieve high efficiency. To provide a rate signal for closed loop operation a brushless dc tachometer integral with the motor was fabricated and tested. The brushless dc torquer developed on this contract results in the following improvements when compared to a high performance brush-type torquer: infinite life, 10/1 reliability improvement, 4/1 lower friction, 3/1 lower rotor inertia, fewer ripple torque cycles per revolution, and improved heat removal from the windings. These are achieved with approximately the same weight and power characteristics. The brushless dc torquer was thoroughly evaluated in a series of functional and environmental tests. These tests showed that the torquer is suitable for long life space missions.
Author (TAB)

N70-38005 Arizona Univ., Tucson.
ELECTRO-THERMAL INTEGRATED CIRCUITS
Paul Russell Gray (Ph.D. Thesis) 1969 202 p
Avail: Univ. Microfilms: HC $9.15/Microfilm $3.00 Order No. 69-19248

A distributed mathematical model is derived for the electro-thermal circuit (ETC) which includes the characterization of lumped and distributed heat sources and temperature sensors arranged in an arbitrary manner on the chip. A set of lumped, network-like models is then derived from the distributed model. A general expression for the ETC transfer function is derived. Several general characteristics common to all ETC transfer functions are derived from this expression. Configurations are derived which yield rational transfer functions, and it is shown that several independent transfer functions can be realized on the same chip. Generalized temperature-stabilized substrate systems are characterized and analyzed, and a procedure is presented for the optimization of the system. The feasibility of the application of ETC filtering to the automatic gain control problem is demonstrated by the design and fabrication of a monolithic detector/AGC filter for use in an AM receiver. Dissert. Abstr.

N70-38084 Rice Univ., Houston, Tex.
MICROWAVE CIRCUIT THEORY AND WAVE PROPAGATION IN A FERRITE-LOADED E-PLANE WAVEGUIDE JUNCTION
Fred Martin Stuber (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-19334

The central portion is considered to be a cylindrical cavity with two longitudinally magnetized ferrite disks positioned against the narrow walls. The field theory relevant to this geometry is studied with emphasis on transverse, longitudinally independent waves. It was suggested that separable TM modes, appropriate for circulating fields, can only exist if radial air spaces or losses are present. Some network properties of a three-port junction are also studied. A flow graph model is shown to be contained in the matching theory. Decomposition theorems on the casade connection of lossless two-ports are derived. Noting that the central portion of the junction cavity is nonpropagating, and employing a lumped two-port transmission line model recently given by Kelly for an evanescent window, it is shown that this leads to an unusual behavior. Kelly's model is reviewed briefly. An error analysis is given which is verified in the application of the model as an impedance transforming element and in the calculations for the evanescent cavity. Dissert. Abstr.

N70-38093# TRW Semiconductors, Inc., Lawndale, Calif.
LONG LIFE RF-POWER TRANSISTORS (LOW NOISE) Semiannual Report, 1 Jul. - 31 Dec. 1969
B. J. Tilley Ft. Monmouth, N.J. ECOM Apr. 1970 97 p refs
(Contract DAAB07-69-C-0447)
(AD-706937; ECOM-0447-1) Avail: CFSTI CSCL 9/1

The objective of the work was to determine the inter-relationships between the noise power output from transistors in broadband power output amplifier stages and the transistor characteristics such that noise generating mechanisms are identified. A complete instrumentation system was designed and set up to allow measurements to be made of high level sideband noise. That is, sideband noise associated with a carrier signal emerging from a transistorized 50 watt RF power amplifier stage. This instrumentation system consisted of a frequency stable low noise driver source, amplifier test fixture, and a noise detection and measuring system. Of particular importance in the noise measuring system is a carrier suppression filter. This filter allows measurements to be made to within 50 KHz of the carrier frequency without the detection system being desensitized due to overloading by high level signals. Data are presented on the measuring system sensitivity, power gain performance of the test transistors and sideband noise measurements. Low level noise source studies have also been conducted in order to identify correlation between these noise sources and the high level noise sidebands. In particular, I/f noise and background noise measurements were made. Author (TAB)

N70-38144# Auburn Univ., Ala. Digital Systems Lab.
DESIGN OF MINIMUM FAULT TEST SCHEDULES AND TESTABLE REALIZATIONS FOR COMBINATIONAL LOGIC CIRCUITS
Le Roy Bearnson and Chester C. Carroll May 1970 157 p refs
(Contract DAAH01-68-C-0296; Themis Proj.)
(AD-706231; THEMIS-AU-T-8) Avail: CFSTI CSCL 9/2

Techniques for deriving the minimum length tests are developed for irredundant combinational circuits that contain single faults. The development is based on the Boolean difference function. The Boolean difference function is expanded to form two analytical expressions that can be used to calculate the tests for any stuck-at-zero and stuck-at-one fault within the circuit. A map method, that allows one to choose a minimum length test directly, is then developed from the analytical expressions. A tabular method, that is amenable to automated programming techniques, is also developed. Both the map and tabular techniques facilitate the derivation of a minimum length test, for a circuit, directly from the Boolean expression that describes it. The effect of circuit redundancy on the test length is also investigated. Bounds are established for the test length required to completely test irredundant logic circuits for single faults. The bounds can also be calculated directly from the Boolean description of the circuit in question. Author (TAB)

N70-38170*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION TESTING OF THERMOFIT SOLDER SLEEVES
9 Sep. 1969 74 p refs
(NASA-TM-X-53879; MSFC-IN-R-QUAL-67-10) Avail: CFSTI CSCL 09A

This report contains data obtained during evaluation testing of thermofit solder sleeve D-101-31 when used on nickel clad copper wire and alloy 63 wire. The tests performed include voltage drop, peel strength, dielectric strength, water immersion, moisture resistance, high temperature aging, and vibration. A test was conducted to determine the optimum heating time of the solder sleeve to obtain maximum peel strength of the joint. Another test, using additional flux, was performed to obtain better wetting of the shield. It was found that very good wetting of the connection was obtained when the shield braid was prefluxed; however, tests indicated that a corrosive flux residue remained in the connection. Voltage drop and peel strength tests of sub splices, a combination of crimp ferrules and solder sleeves, were included. Author

N70-38201* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-VOLTAGE CABLE Patent
Walter F. Krieve, inventor (to NASA) Issued 8 Oct. 1963 (Filed 20 Jun. 1962) 4 p Cl. 174-115 Sponsored by NASA
(NASA-Case-XNP-00738; US-Patent-3,106,603; US-Patent-Appl-SN-204015) Avail: US Patent Office CSCL 09A

A high voltage cable for use in fields of high intensity ionizing radiation is described, which minimizes or neutralizes leakage current in the radiation fields and can carry high voltages without breakdown. An insulating tubing with a hollow center is coated on its inner wall with a thin conductive coating and on its outer wall with a thicker conductive coating. A thin conductor, preferably made of a high density metal such as platinum, extends through the center cavity and touches the coating on the inner wall at various places along its length. The thin conductor has high potential applied to it, and the coating on the outside of the tubing is the ground connection. Gamma rays of the ionization field cause

a liberation of electrons from the conductor which travel outward to the outer conductive coating. Thus, a current flow is provided which is opposite to the one caused by the electron liberation due to gamma ray bombardment of the insulating tube. The high voltage cable is also useful as a high voltage Compton cell and may be used as a radiation detector for high intensity fields. P.A.B.

N70-38485# Siemens A.G., Munich (West Germany)
DEVELOPMENT OF A GRIDDED POWER TUBE FOR SPACE APPLICATION [ENTWICKLUNG EINER GITTERGESTEUERTEN SENDEROEHRE FUER RAUMFLUGANWENDUNG]
W. Schneider Apr. 1970 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-25) Avail: CFSTI; ZLDI Munich: 7,15 DM

Gridded power tubes for space applications require particularly powerful and reliable long-life cathodes. Metal dispenser cathodes coated with osmium for higher emission meet these requirements. Osmium-coated cathodes can now be fabricated with a more uniform quality. Investigations on a planar triode with 15 W CW output power showed that long life can be expected if the cathode operating temperature is established taking into account the back-heating effect under R.F. conditions. The deposits on the ceramic of a 100 W planar triode during CW operation were suppressed by extensive redesign. Author (ESRO)

N70-38486# Siemens-Schuckertwerke A. G., Erlangen (West Germany). Forschungslaboratorium.
INVESTIGATIONS INTO THE RADIATION DAMAGE OF SEMICONDUCTOR DEVICES AND THE RADIATION HARDENING OF PLANAR TRANSISTORS BY MEANS OF IRRADIATION-ANNEALING CYCLES [UNTERSUCHUNGEN UEBER DIE STRAHLENSCHAEDIGUNG VON HALBLEITERBAUELEMENTEN SOWIE UEBER DIE VERBESSERUNG DER STRAHLENRESISTENZ VON PLANARTRANSISTOREN DURCH BESTRAHLUNGS-AUSHEIL-ZYKLEN]
R. Baeuerlein, W. Krueger, D. Uhl, and H. Arndt May 1970 184 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-26) Avail: CFSTI; ZLDI Munich: 37,80 DM

This report deals with (1) changes in the electrical characteristics of n-p-n silicon planar transistors and radiation damage to germanium tunnel diodes due to electron and proton radiation (2) changes in the electrical properties of MOSFETS by 3 - 24 keV electrons (3) the ionisation annealing mechanism and a comparison of the radiation damage due to ionisation effects in different n-p-n silicon planar devices. Author (ESRO)

N70-38496# Lincoln Lab., Mass. Inst. of Tech., Lexington.
QUANTIZATION EFFECTS IN DIGITAL FILTERS
Clifford J. Weinstein 21 Nov. 1969 107 p refs
(Contract AF 19(628)-5167)
(AD-706862; TR-468; ESD-TR-69-348) Avail: CFSTI CSCL 9/5

Quantization effects in digital filters can be divided into four main categories: quantization of system coefficients, errors due to A-D conversion, errors due to roundoffs in the arithmetic, and a constraint on signal level due to the requirement that overflow must be prevented in the comparison. The effects of quantization on implementations of two basic algorithms of digital filtering-the first-or second-order linear recursive difference equation, and the fast Fourier transform (FFT) - are studied in some detail. For these algorithms, the differing quantization effects of fixed point, floating point, and block floating point arithmetic are examined and compared. The ideas developed in the study of simple recursive filters and the FFT are applied to analyze the effects of coefficient quantization, roundoff noise, and the overflow constraint in two more complicated types of digital filters - frequency sampling and FFT filters. Realizations of the same filter design, by means of the frequency sampling and FFT methods, are compared on the basis of differing quantization effects. All the noise analyses in the report are based on simple statistical models for roundoff and A-D conversion errors. Experimental noise measurements testing the predictions of these models are reported, and the empirical results are generally in good agreement with the statistical predictions. Author (TAB)

N70-38516# Physics International Co., San Leandro, Calif.
THE ADVANCED DEVELOPMENT OF WATER TRIGATRON AND THREE-ELECTRODE SULFUR HEXAFLUORIDE SWITCHES Final Report
T. Fleischman and I. Smith Jan. 1970 106 p
(Contract DASA01-68-C-0136)
(AD-707407; PIFR-114; DASA-2427) Avail: CFSTI CSCL 9/1

The operation of a water trigatron, pulse charged in the region of about 250 kV, has been investigated and has led to the conclusion that although the switch seemed to be triggerable, the delay was so long, 200 nsec and the jitter so large the switch was not practical for most purposes. On the other hand, a three-electrode SF6-filled switch produced some promising results with jitters of 1 to 10 nsec. An improved version of the SF6 three electrode switch was tested in an oil rather than a water environment, pulse charged up to 1.25 MV and subnanosecond jitters were frequently obtained. The resistive phase of spark breakdown in SF6 and freon was also measured. Author (TAB)

N70-38604* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE FREQUENCY MAGNETIC MULTIVIBRATOR Patent
Stephen Paull, inventor (to NASA) Issued 7 Apr. 1964 (Filed 18 Sep. 1961) 8 p Cl. 307-88
(NASA-Case-XGS-00458; US-Patent-3,128,389; US-Patent-Appl-SN-139006) Avail: US Patent Office CSCL 09E

A variable frequency magnetic-coupled multivibrator circuit is described in which the frequency of the output signal is continuously variable over a predetermined range and the output signal is free of random variations of period during each half-cycle of operation. Improved operating stability over a wide range of temperatures and variations in bias voltages is described. The multivibrator has electronic on-off gating and has a temperature compensated full wave frequency control circuit for providing stable operations over a wide range of ambient temperature variations. P.A.B.

N70-38623# Naval Postgraduate School, Monterey, Calif.
A STUDY OF GYRATOR CIRCUITS
James John Kulesz, Jr. (M.S. Thesis) Dec. 1969 95 p refs
(AD-706726) Avail: CFSTI CSCL 9/5

Since the introduction of the gyrator in 1948, numerous papers have been written concerning the implementation and application of these network devices. Gyrators have been realized utilizing vacuum tubes, transistors, and operational amplifiers to obtain their nonreciprocal property. It is the purpose of the thesis to consolidate the current findings. A section is presented on each of the active devices mentioned above. The individual sections consist of summaries of published gyrator realizations. The method used to obtain the gyrator properties, along with appropriate equations, is that of the original circuit designer. Some relations and equations have been modified to standardize notation, or to express them in a more convenient form. Where available, experimental test circuits have been included to support the synthesis method. Author (TAB)

N70-38636# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR SEMICONDUCTOR RESISTORS BASED ON TIN OXIDE FOR ELECTROLUMINESCENT MATRIX SCREENS
B. K. Chernyi 30 Jan. 1970 23 p refs Transl. into ENGLISH from Fiz.-Tekhnol. Vopr. Kibernetiki (USSR), no. 2, 1966 p 66-91
(AD-706648; FTD-HT-23-19-70) Avail: CFSTI CSCL 9/1

The oxide systems ZnO-SnU2, CoO-SnO2, and NiO-SnO2 were studied as nonlinear, semiconducting resistors which can be used to increase the contrast for electroluminescent matrix screens. From a study of the conductivity and v. amp. characteristics of these systems it was concluded that the compound 20 percent ZnO-80 percent SnOsub2 has the best nonlinear properties with a coefficient of non linearity of approximately 10, a specific resistance of 10 super 9 ohm. cm and dielectric permeability on the order of 40 at a frequency of 5 kHz. Author (TAB)

N70-38638# Ohio State Univ., Columbus. ElectroScience Lab.
THE WIDE ANGLE SIDE LOBES OF REFLECTOR ANTENNAS
P. A. J. Ratnasiri, R. G. Kouyoumjian, and P. H. Pathak 23 Mar. 1970 60 p refs
(Contract AF 19(628)-5929)
(AD-707105; OSURF-2183-1; AFCRL-69-0413; SR-4) Avail: CFSTI CSCL 9/5

The complete pattern of a parabolic reflector antenna was calculated using the singly-diffracted rays of the geometrical theory of diffraction, with proper corrections for the forward and real axial directions. Excellent agreement with experimental patterns can be expected, if the aperture blockage is not significant. The solution has the usual advantages of a solution based on the geometrical theroy of diffraction, namely, it is obtained in the form of simple functions, its computation cost is low, it is directly related to the radiation mechanism of the antenna and so it can be readily used in the design problem, and it can be easily extended and modified as the need arises. Author (TAB)

N70-38657# ARO, Inc., Arnold Air Force Station, Tenn.
FREQUENCY HETERODYNING IN PHOTOMULTIPLIER TUBES Final Report, Jul. - Dec. 1969
F. L. Crosswy and H. T. Kalb AEDC May 1970 35 p ref
(Contract F40600-69-C-0001)
(AD-706383; AEDC-TR-70-35) Avail: CFSTI CSCL 9/1

Photomultiplier tubes with a suitable electrode structure were investigated for use in a superheterodyne-type signal receiver for the Doppler shift laser velocimeter (LV). An oscillator signal impressed upon specially constructed electrodes within the photomultiplier tube produced a signal at a frequency which was the difference between the oscillator and the LV signal frequencies. The high gain of the photomultiplier tube then amplified the difference frequency signal to a usable level. Two different tubes were investigated and found to be useful as heterodyne photomultiplier tube amplifiers. The circuit design, experimental results, and applications are discussed. Author (TAB)

N70-38684 National Lending Library for Science and Technology, Boston Spa (England).
SEMI-CONDUCTOR DETECTORS FOR CURRENT DENSITY MEASUREMENTS IN THE ELECTRON MICROSCOPE [HALBLEITERDETEKTOREN ZUR STROMPICHTEMESSUNG IM ELEKTRONENMIKROSKOP]
K. H. Herrmann et al 6 Mar. 1970 13 p refs Transl. into ENGLISH of Siemens report Eg 1/204 In ENGLISH and GERMAN (NLL-Windscale-Trans-421-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The application of semiconductors to radiation measurement in the final image plane of an electron microscope is discussed. The coupling of this measuring method with recording equipment, the advantages, disadvantages, and limitations of the method are also discussed. Some examples of the uses of these measurements are given. Author

N70-38712* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRONIC MOTOR CONTROL SYSTEM Patent
Harrison N. Thomas, inventor (to NASA) Issued 1 Sep. 1964 (Filed 16 Apr. 1963) 9 p Cl. 318-260
(NASA-Case-XMF-01129; US-Patent-3,147,422; US-Patent-Appl-SN-273534) Avail: US Patent Office CSCL 09C

An electric circuit system for controlling the speed of a motor, and particularly a rapid and precise decrease in speed, is described. The motor is powered by two energizing circuits, each consisting of an alternating current supply connected in series to the motor through a current controlling thyratron. One circuit provides driving power for the motor at a speed determined by its current control thyratron. The other energizing circuit provides electrical braking power determined by its current control tube. Phase shifted ac sources in series with the control signal and thyratron grids to achieve a normal 90 deg lagging grid voltage. When necessary to attain the normally cutoff condition of the thyratron in the braking control circuit, an additional fixed negative bias source is connected to both control signals. N.E.N.

N70-38761# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THERMAL BEHAVIOR IDENTIFICATION OF A POWER DIODE [IDENTIFIKATION DES THERMISCHEN VERHALTENS EINER HOCHLEISTUNGSDIODE]
Willi Koechli (Ph.D. Thesis) 1969 127 p refs In GERMAN; ENGLISH summary
(Diss-4200) Avail: CFSTI

Described are measurements of the dynamic thermal behaviour of a diode of type Secheron Si H 150 C1. In one case the current is given as a step function, in the other case it is a single short circuit half wave. The velocity of cooling air flow is a parameter. These measurements are used for the identification of the elements of an RC-model. The resulting RC-model approximates 10 different measured functions with good precision. Only the last resistor depends on the velocity of air flow. The mathematical application of this RC-model is demonstrated for a good number of current functions. On the one hand the behavior of the silicon temperature can be calculated from the given current function, on the other hand the limit values of certain parameters of this function can be calculated from the allowed maximum of silicon temperature. Author

N70-38987# Small Business Administration, Washington, D.C.
SELECTED ADVANCES IN ELECTRICAL TECHNOLOGY
1969 32 p refs

Innovations in electrical and electronics devices and processes are described as abstracted from NASA/AEC Tech Briefs, government-owned patents, and Clearinghouse reports. E.H.W.

N70-38988# Joint Publications Research Service, Washington, D.C.
SET OF METAL-DIELECTRIC-SEMICONDUCTOR INTEGRATED LOGIC CIRCUITS FOR AUTOMATION AND TELEMECHANICS SYSTEMS
I. V. Prangishvili et al 24 Aug. 1970 10 p refs Transl. into ENGLISH from Prib. Tekh. Eksp. (USSR), no. 4, 1970 p 45-48
(JPRS-51228) Avail: CFSTI

Metal dielectric integrated circuits were constructed for use in complex automatic telemechanic systems. The circuits were

designed to have high reliability, low weight, small size, low power consumption, simple production qualities, and low cost. Advantages over other known integrated circuits include high separation factor of inputs and outputs, and high interference stability particularly with respect to the power supply. E.H.W.

N70-38995* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE FREQUENCY MAGNETIC MULTIVIBRATOR Patent
Stephen Pauk, inventor (to NASA) Issued 22 Sep. 1964 (Filed 11 Mar. 1960) 6 p Cl. 331-113
(NASA-Case-XGS-00131; US-Patent-3,150,329; US-Patent-Appl-SN-14488) Avail: US Patent Office CSCL 09E

A variable frequency magnetic coupled multivibrator is described which operates under constant switching conditions over the entire frequency range of operation, as a means of assuring that the output signal exhibits constant amplitude and waveshape characteristics and is free of random variations of period from cycle to cycle. The circuit elements and their arrangement and operation are discussed, including the high remanence magnetic cores, electrical energy source, conductive loops, switching means, control winding, and circuit means for applying a variable single polarity unidirectional signal to the control winding. P.A.B.

N70-38998* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME-DIVISION MULTIPLEXER Patent
John F. Meyer, inventor (to NASA) Issued 6 Aug. 1963 (Filed 29 Sep. 1961) 6 p Cl. 340-147 Sponsored by NASA
(NASA-Case-XNP-00431; US-Patent-3,100,294; US-Patent-Appl-SN-180380) Avail: US Patent Office CSCL 09E

The multiplexing apparatus is described as simplified, economical to operate, reliable despite power failures, and capable of assuming its correct operation sequence within a minimum interval from the time of starting. A plurality of magnetic latching relays are employed in a circuit configuration to effectuate their sequential operation. The latching relays are divided into two groups. Two phase-displaced clock pulses are provided. Circuitry of the relays is arranged so that a latching relay in one group is driven in response to the condition of operation of the relays in the other group and a clock pulse of a particular phase. The latching relays are thus operated from one of their latching conditions to a second one in sequence. No active or passive electrical components are required in the interconnection of the relays, and the logical design allows the operation to start from any one of the 502 possible nonoperating states. The relay deck then assumes its correct operating sequence within a frame period. P.A.B.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-37686# Minnesota Univ., Minneapolis. Inst. of Technology.
MATHEMATICAL THEORY OF CONTROL OF NONLINEAR PROCESSES Yearly Report, 1 Jan. - 31 Dec. 1969
E. B. Lee May 1970 10 p
(Grant AF-AFOSR-1502-68)
(AD-706908; AFOSR-70-1500TR) Avail: CFSTI CSCL 12/1

Primary emphasis during the year has been on the development of controller design techniques for systems with distributed parameters, and time delays. Necessary, and in some cases sufficient conditions, were found for the determination of the control policy to use when there are delays in the control action as well as the state. These results could be used in the synthesis of controllers for vehicles which are in space and the control decisions are made by equipment or men on the earth. Various approximations to be used in the modeling of systems with distributed parameters have been investigated. Approximate models for systems with distributed parameters have been achieved using a lumped parameter approach with time delays in the interaction between the lumps. Such models retain essential features, such as controllability, of the distributed parameter system and should prove useful in the design of boundary controllers for flexible plates or membranes (which occurs in the control of certain large flexible aircraft structures). Significant results have been achieved in the theory of feedback control for linear systems with time delays and the quadratic performance criterion. Author (TAB)

N70-37786*# Tulane Univ., New Orleans, La. Systems Lab.
DESIGNERS MANUAL FOR CIRCUIT DESIGN BY ANALOG/DIGITAL TECHNIQUES Final Report
Charles H. Beck and Ming H. Kuo Jul. 1970 85 p refs
(Contract NAS12-2059)
(NASA-CR-113113) Avail: CFSTI CSCL 09A

A hybrid computer system, and hybrid techniques which were applied to circuit design are described. These techniques serve as useful supplements to the basic digital Network Analysis System Applications Program in designing models of electronic devices, performing transient analysis of linear and nonlinear circuits, and the direct design of dynamic systems based on design specifications. Results from employing high-speed, fully-automated techniques for obtaining models of systems based on time-domain measurements or specifications are included. Author

N70-37905 Michigan Univ., Ann Arbor.
THE SCATTERING OF ELECTROMAGNETIC WAVES BY MOVING BODIES
Jon Allen Soper (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-18113

An analysis is made of the transient behavior of the total far zone field when an electromagnetic pulse is incident upon a uniformly moving, perfectly conducting wedge. The solution for the total field is obtained using the concepts of the Special Theory of Relativity. An integral solution for the total field in the primed or moving frame is obtained as a contour integral along the well known Sommerfeld contours by means of Laplace transformation techniques. This result is then transformed to the reference frame of a stationary observer by means of the Lorentz Transformations. The total field is determined for three different incident fields; the time harmonic phase wave, the unit step plane pulse and the cylindrical impulse. Dissert. Abstr.

N70-38019# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE ELECTROMAGNETIC FIELDS OF A DIPOLE IN A DISSIPATIVE HALF-SPACE: A NUMERICAL APPROACH
Marvin Siegel May 1970 97 p refs
(Contract N00014-67-A-0298-0005; Grant NSF GK-3800)
(AD-706367; TR-607) Avail: CFSTI CSCL 20/14

The theory for the numerical solution which evaluates the electromagnetic fields of a dipole in a dissipative half-space has been developed which is especially useful where asymptotic forms are not available or valid. In addition, to permit better use of the explicit forms of the asymptotic solutions, the restrictions implicit in the formulation of the approximations for the fields in the three subdivisions of horizontal range (near, intermediate, and asymptotic range) were analyzed. Practical tables were developed showing Valid Regions for Application of Banos Asymptotic Formulas for sea water, lake water, wet earth, and dry earth, over the useful frequency range. Author (TAB)

N70-38047# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.

A COMPUTER PROGRAM FOR THE DESIGN OF MULTIVARIABLE DECOUPLED FEEDBACK SYSTEMS

John R. Pivnichny May 1970 29 p refs

(Grant AF-AFOSR-814-66)

(AD-706396; AFOSR-70-1286TR) Avail: CFSTI CSCL 12/1

The computer program was written to calculate all the data required for Gilberts solution to the decoupling problem. Input to the program consists of the A, B, and C matrices in part 1 of his paper. Output is the integers, constants, and matrices listed in part 8. A mathematical description of the calculations required is found in a paper by Gilbert and Pivnichny. The purpose of this report is to describe the actual program in sufficient detail so that the reader who is familiar with the previously mentioned papers of Gilbert, and Gilbert and Pivnichny will be able to use the program to solve specific decoupling problems. A description of the program, input and output data formats, a flowchart, a program listing, and a sample problem are given. TAB

N70-38160# New York Univ., N.Y. Dept. of Electrical Engineering.

STATE ESTIMATION FROM MEASUREMENTS WITH CORRELATED NOISE WITHOUT USING DIFFERENTIATORS

Scientific Interim Report

Philip E. Sarachik May 1970 23 p refs

(Grant AF-AFOSR-1526-68)

(AD-706080; AFOSR-70-1243TR) Avail: CFSTI CSCL 12/1

The paper considers the problem of estimating the state of noisy linear systems without the use of differentiators when at least one of the output measurements is corrupted by noise. Author (TAB)

N70-38244# Joint Publications Research Service, Washington, D.C.

PNEUMATIC AUTOMATION AND LOCAL CONTROL SYSTEMS DESIGNS

20 Aug. 1970 22 p refs Transl. into ENGLISH from Prib. Sist. Upr. (USSR), no. 6, 1970 p 31-36

(JPRS-51213) Avail: CFSTI

CONTENTS:

1. FLUIDIC-PNEUMATIC APPARATUS V. I. Chernyshev et al p 1-9 refs (See N70-38245 21-12)

2. PROBLEMS IN DESIGNING DIGITAL EQUIPMENT FOR LOCAL CONTROL SYSTEMS Ye. K. Kurg et al p 10-20 refs (See N70-38246 21-10)

N70-38246# Joint Publications Research Service, Washington, D.C.

PROBLEMS IN DESIGNING DIGITAL EQUIPMENT FOR LOCAL CONTROL SYSTEMS

Ye. K. Krug et al *In its* Pneumatic Automation and Local Control Systems Designs 20 Aug. 1970 p 10-20 refs (See N70-38244 21-10)

Avail: CFSTI

An attempt was made to substantiate the selection of basic functional subassemblies for control and regulating devices, and type sizes of the plates and logical elements for the subassemblies. Author

N70-38341# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.

AN ILL-CONDITIONING PROBLEM WITH IMPLICIT INTEGRATION

Donald A. Calahan and C. W. Gear May 1970 7 p refs

(Grant AF-AFOSR-1217-67)

(AD-706913; AFOSR-70-1472TR) Avail: CFSTI CSCL 9/5

The use of implicit integration of odes to avoid the split time constant problem has been thought of as a numerical panacea, especially since the associated matrix reduction problem has been alleviated using highly-efficient computer-generated matrix reduction algorithms. This letter points out a significant exception to this premis, demonstrated in a circuit analysis context. Author (TAB)

N70-38345# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

EFFECT OF ATMOSPHERIC HUMIDITY ON BREAKDOWN VOLTAGE OF VARIOUS SPARKOVER LENGTHS AT VARIOUS VOLTAGE FORMS [EINFLUSS DER LUFTFEUCHTIGKEIT AUF DIE DURCHBRUCHSPANNUNG VERSCHIEDENER FUNKENSTRECKEN BEI VERSCHIDENEN SPANNUNGSFORMEN]

Mohamed Sabri Guindehi (Ph.D. Thesis) 1969 140 p refs In GERMAN

(Diss-4347) Avail: CFSTI

Investigated are causes of humidity induced voltage breakdown in spark gaps. It is shown that increased breakdown probability is caused by: (1) free electron adsorption onto the water molecule and the compensatory production of new electrons and increased field strength; and (2) formation of a negative ion-field charge in the forefront of the positive charge field of the positive electrode; this weakens the positive charge field towards the cathode so that humidity increases and a still higher charge is necessary for flashover. The reaction is determined by electrode form, spark gap distance, and the corresponding flashover mechanism. Transl. by G.G.

N70-38467# Texas Univ., Austin. Electronics Research Center.

JOINT SERVICES ELECTRONICS PROGRAM

D. G. Swanson, ed., Edward J. Powers, Francis X. Bostick, Philip C. Richardson, and Baxter F. Womack 15 May 1970 457 p refs *Its* Biann. of Electron. Res. No. 11

(Grant AF-AFOSR-1792-69)

(AD-707452; AFOSR-70-1002TR) Avail: CFSTI CSCL 9/3

Research topics in progress, recent findings, and future plans in the areas of biomedical electronics; information sciences; plasma and quantum electronics; solid state electronics and acoustics and radio sciences are presented. This eleventh biannual is highlighted by new results obtained in several of these areas. Author (TAB)

N70-38509# Naval Postgraduate School, Monterey, Calif.

ON THE IMPLEMENTATION OF REDUCED SUB-OPTIMAL KALMAN FILTERS, FOR DISCRETE, LINEAR, STOCHASTIC PROCESSES WITH TIME-INVARIANT DYNAMICS

Juan Francisco Lara (M.S. Thesis) Dec. 1969 133 p refs

(AD-706725) Avail: CFSTI CSCL 12/1

Three different approaches to the problem of implementing a reduced-order, sub-optimal Kalman filter for a discrete, linear stochastic process, with time-invariant dynamics, are presented. A first method, A, is based upon the partitioning of the system dynamics. A second method, B, is implemented using matrix pseudo-inversion and a third method, C, is based upon reduction of the original process to one of lower order using the dominant roots of the system. An expression for the performance degradation in method A is derived. In method B, expression for the sub-optimal estimation error, and sub-optimal variance of estimation error are derived. The several methods are applied to a fourth-order process for illustration. Author (TAB)

N70-38534# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOSCOW. INSTITUTE OF AUTOMATION AND

TELEMECHANICS (TECHNICAL CYBERNETICS). SYSTEMS WITH A VARIABLE STRUCTURE AND THEIR APPLICATION TO PROBLEMS DEALING WITH THE AUTOMATION OF FLIGHT: SELECTED ARTICLES

E. N. Dubrovskii et al. 18 Mar. 1970 117 p refs Transl. into ENGLISH from Sistemy s Peremen. Strukt. i Ikh Primeneniye v Zadachakh Avtomatiz. Poleta (Moscow), 1968 p 34 - 50, 54 - 71
(AD-706798; FTD-MT-24-432-69) Avail: CFSTI CSCL 12/1

Contents: Adaptive system of automatic control with variable by structure with limited controlling influence; Means of reducing of the volume of information, necessary for the construction of a composite variable-structure automatic control system; Synthesis of variable-structure system without the use of undistorted derivaties from error signal in the control law; Systems with variable-structure along with a delay in switching elements; Stability conditions of forced motion in variable-structure systems; On one approach to the problems of the synthesis of variable-structure systems; On the problem of the stability of motion of variable-structure systems for control objects with variable parameters; and Variable-structure control system for a flexible object. TAB

N70-38576# Stanford Univ., Calif. Electronics Lab.
QUASILOSSLESS TRANSFER SCATTERING MATRIX SYNTHESIS

Thomas Gibbons Liang Mar. 1970 55 p refs
(Contract Nonr-225(83))
(AD-706103; SU-SEL-70-012; TR-6560-20) Avail: CFSTI CSCL 9/5

The work is a continuation of passive quasilossless time-varying synthesis methods by factorization of a class of the transfer scattering matrix. The transfer scattering description of networks is not as general as the scattering description, but a synthesis that results directly from the transfer scattering matrix may produce new leads for a different approach to time-varying lossy synthesis and may even serve a path to synthesis of networks with time delays. This work does not present the complete theory of transfer scattering synthesis, because only one of many forms of the transfer scattering matrix is presented. Author (TAB)

N70-38616# Joint Publications Research Service, Washington, D.C.
AUTOMATIC CONTROL SYSTEMS: SELECTED ARTICLES

V. A. Bayda et al. 14 Aug. 1970 59 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, May 1970 59 p
(JPRS-51172)

Selected articles are presented on automatic control systems for thermal power plants, pneumatic devices, modular jet type elements, complex computing equipment, jet type elements of the Volga system, and pneumonics in typesetters. Research and development procedures for the production of pneumonics elements and modules from plastics, and integrated circuit production and use in microelectronics are also discussed. E.H.W.

N70-38759# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ELECTRIC IMPEDANCE CALCULATION FOR MULTIPHASE RECTANGULAR CONDUCTOR SYSTEMS BY ANALOG METHOD [BERECHNUNG DER STROMVERDRAENGUNG IN MEHRPHASIGEN RECHTECKLEITER-SYSTEMEN MIT HILFE EINES ANALOGIEVERFAHRENS]

Hans-Juerg Sigg (Ph.D. Thesis) 1969 129 p refs In GERMAN; ENGLISH summary
(Diss-4219) Avail: CFSTI

The Maxwell equations for a system of multiple straight transmission lines are reduced to the differential equations for the electric potential phi and the magnetic potential A sub z. These are solved approximately with the aid of an analogue capacitor-resistor network. The parameters of the transmission lines Z sub ik and Y sub ik which form the matrices of impedance per unit length and admittance per unit length, respectively, are measured directly on the network. Measurements are given for systems of one, two and three rectangular conductors, which are equally spaced and have their centre lines in the same plane, showing pronounced proximity effect at low frequencies (skin depth of the order of conductor thickness) and at high frequencies (skin depth much smaller than thickness). Author

N70-38971 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTRICAL CHARACTERISTICS AND FLUCTUATION PHENOMENA IN SEMICONDUCTOR DOUBLE INJECTION DEVICES

Ronald W. Knepper (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-19099

Studies were performed on semiconductor double injection devices for the purpose of understanding the mechanisms affecting current transport and electrical fluctuations in the bulk region of these devices. A one-dimensional numerical computer analysis was performed to explain the d.c. current-voltage bulk characteristics. The analysis revealed that carrier-carrier scattering was responsible for the voltage drop across the bulk region while space charge had no effect on the current transport in this region. The effect of the electrons originally contributed by the shallow donor impurities (Lampert semiconductor regime model) was shown to significantly influence the bulk characteristic for the longer devices studied. A simple noise theory was derived to explain the observed electrical fluctuations. The theory provided good agreement with the observed noise if both carrier-carrier scattering and filamentary current conduction were assumed. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-37628# Hartman-Huyck Systems Co., Huntington Station, N.Y.
REAR PROJECTION DISPLAY DEVICES Final Report, Jun. 1967 - Jan. 1969

Robert Archer Feb. 1970 68 p refs
(Contract F33615-67-C-1951)
(AD-706399; AFAL-TR-69-343) Avail: CFSTI CSCL 14/2

The report describes a high-brightness rear projection display device with a 10-inch display screen. It was designed to serve as a research tool for testing observers with different display and sensor parameters. Controllable film illumination is supplied by either a tungsten lamp or a 2500-watt xenon arc lamp. Either 70 mm or 5-inch film can be used. Film gate position, controlled by a joystick, is indicated by a cross hair position display. To simulate a wide range of aircraft speeds, the film motion rate is continuously variable from 3 to 30 feet per minute. The device is large and heavy and is intended only for laboratory use. Its construction emphasized flexibility, ruggedness, and reliability rather than portability. Author (TAB)

N70-37832*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE ONERA HOT SHOT WIND TUNNELS CAPABILITIES

IN THE SPACE SHUTTLE STUDIES
Jean-Pierre Chevallier *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 119-126 refs
(See N70-37826 21-31)
Avail: CFSTI CSCL 14B

The ARC1 and ARC2 wind tunnels of ONERA, designed for hypersonic studies at Mach numbers from 15 to 20 with large variations of the Reynolds number, are described. The main features of the tunnels, their simulation range, and equipment, with examples of studies on electromagnetic wave transmission in the plasma, are given in tabular form. R.B.

N70-37969# Kaman Nuclear, Colorado Springs, Colo.
PRESSURE AND PARTICLE VELOCITY MEASUREMENTS IN DASACON Final Report
William A. Fraser Oct. 1969 45 p
(Contracts DASA01-67-C-0111; DA-49-146-XZ-548)
(AD-706757; KN-69-478(R); DASA-2448) Avail: CFSTI CSCL 14/2

In the fall of 1968 the conical shock tube, DASACON, at the Naval Weapons Laboratory in Dahlgren, Virginia was instrumented with a system designed to make air flow speed measurements. The measurements were made at the third or largest test station in DASACON. During the series of tests a variety of driver charge weights, varying from 60 to 700 lbs of TNT, was used. This essentially covers DASACONs range of capabilities. The principal results of the test program were the following: (1) In those regions of the shock tube where flow is not disturbed by mounting structures the measured air speed versus time profiles agree well with profiles based on a method of characteristics analysis. The measured peak speeds are well predicted by means of existing peak pressure data. unsteady for extended periods after shock arrival. The duration of this turbulent flow increased with charge size. Author (TAB)

N70-38050# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE MK 2 UTIAS IMPLOSION-DRIVEN HYPERVELOCITY LAUNCHER DESIGN ANALYSIS
V. C. D. Dawson, R. A. Waser and D. O. Oakes Mar. 1970 36 p refs
(Contract AF 33(615)-5313)
(AD-707111; UTIAS-TN-147) Avail: CFSTI CSCL 14/2

Based on initial experiments carried out on the 8 in dia implosion-driven hypervelocity launcher, as well as on a preliminary design study of a larger launcher facility, the design of a 30 in dia hypervelocity launcher was completed, and a set of detailed workshop drawings has been prepared. The report describes the basic functioning of the implosion-driven hypervelocity launcher, as well as its mechanical design, operation and firing procedures. A separate section is devoted to the strength requirements and initial stressing. By using a simple analogy with a spherical pressure chamber, an estimate is made of the plastic/elastic stress level, from which some prediction of fatigue life for such a launcher was derived. The last two sections of this report give some recommendations for the proof-testing of the launcher, as well as some basic aspects regarding safety. Author (TAB)

N70-38063# Center for Naval Analyses, Arlington, Va.
THE COVARIANCE MATRIX OF THE LIMITED INFORMATION ESTIMATOR AND THE IDENTIFICATION TEST: COMMENT
Franklin M. Fisher and Joseph B. Kadane 14 May 1970 11 p refs *Its* Professional Paper No. 34
(AD-706310) Avail: CFSTI CSCL 12/1

In their article, Liu and Breen propose a new estimator of the large-sample asymptotic covariance matrix for the limited information maximum likelihood estimator in simultaneous equations, and question the interpretation of a statistic used in the past to test overidentifying restrictions. The present paper comments on this matter. TAB

N70-38180# Kernforschungszentrum, Karlsruhe (West Germany).
LINEAR ION ACCELERATOR WITH HOMOGENEOUS-SPACE STRONG FOCUSING [LINEAR-IONENBESCHLEUNIGER MIT RAEUMLICH-HOMOGENER, STARKER FOKUSSIERUNG]
I. M. Kapchinskii (Inst. fuer Theoretische und Exptl. Phys., Moscow) et al 2 Sep. 1969 12 p refs Translated into GERMAN from Russian Report In GERMAN Presented at the 7th Conf. on High Energy Accelerators, Moscow, 28 Aug.-2 Sep. 1969
(KFK-tr-312; CONF-690811-14) Avail: AEC Depository Libraries

Proposals for a linear ion accelerator are discussed. Focusing and acceleration are achieved by an electric high-frequency field produced by a long four-conductor system. The accelerator contains no drift tube. Advantages of the proposed accelerator are simplicity of construction, small diameter, and low injection energy even at high beam intensities. Author (NSA)

N70-38182* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPULSION BLADDER-EQUIPPED STORAGE TANK STRUCTURE Patent
Edgar F. Koch, inventor (to NASA) Issued 3 Mar. 1964 (Filed 4 Oct. 1962) 5 p Cl. 220-63 Sponsored by NASA
(NASA-Case-XNP-00612; US-Patent-3,123,248; US-Patent-Appl-SN-228507) Avail: US Patent Office CSCL 13D

The storage tank structure described is arranged in such a manner that the bladder collapses in a predetermined pattern as its contents are depleted, or, conversely, expands in a complementary pattern as the bladder is filled. The pattern of collapse or expansion is such that three-corner folding or other creasing of the bladder, which would introduce localized stresses in the walls of the bladder and consequent wear or rupture, is avoided. Mass movement of the contents of the bladder is minimized. The normally spherical bladder is provided with a yieldable support diametrically opposite its outlet. It is contained in a tank having a dimension along the axis of the bladder between the outlet and yieldable support, which is at least equal to the extended length of the bladder when its contents are depleted. Therefore, the bladder folds radially inwardly, but is not forced to fold longitudinally. P.A.B.

N70-38196* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GRAVITY DEVICE Patent
Josef Boehm, inventor (to NASA) Issued 21 Jul. 1964 (Filed 15 Dec. 1961) 5 p Cl. 73-517
(NASA-Case-XMF-00424; US-Patent-3,141,340; US-Patent-Appl-SN-159804) Avail: US Patent Office CSCL 14B

A gravity device is described which has a passageway containing a ball adapted to accelerate undisturbed within the passageway in response to gravitational force. The device also includes a light source and photoelectric cell for detecting the exact position of the ball within the elongated passageway. Any displacement of the ball from its initial position within the passageway represents the difference between the carrier's acceleration and the gravitational acceleration which achieves zero gravity conditions aboard the carrier as it moves toward the gravitational center. R.B.

N70-38202* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UMBILICAL SEPARATOR FOR ROCKETS Patent
Alan K. Forsythe, inventor (to NASA) Issued 3 Dec. 1963 (Filed 7 Mar. 1962) 6 p Cl. 89-1.7 Sponsored by NASA
(NASA-Case-XNP-00425; US-Patent-3,112,672;

US-Patent-Appl-SN-180396) Avail: US Patent Office CSCL 22D

An umbilical separator is described in which the various electrical connectors and fluid couplings may be quickly and dependably separated simultaneously on command. One of the pressure fluid lines connected to the rocket is utilized to operate the separator; this pressure line is opened by the energizing on remote command of a solenoid valve. The pressure is transmitted through the liquid, a process which connects the cylinders so that all of their extensible stems are moved. Piston and cylinder units operate thrust pins in unison and are so interconnected that all thrust pins are forced to move equal distances irrespective of the relative loads imposed on the pins. Thus, the separator does not twist a cant to bind the connectors or couplings as they are being separated. Conventional multiple conductor electrical connectors and conventional fluid couplings of the type which may be separated without fluid loss are utilized and may be arranged in any convenient manner. P.A.B.

N70-38227# United Kingdom Atomic Energy Authority, Harwell (England).

THE HARWELL SPUTTERED ION GUN

K. J. Hill, R. S. Nelson, and R. J. Francis Mar. 1970 16 p refs

(AERE-R-6343) Avail: AEC Depository Libraries; HMSO 3s 6d; BIS $0.70

An ion source is described, which produces ion beams of any element without the requirement of a furnace. The sputtered ion gun is adaptable to different techniques which suit specific source materials. It is particularly useful in obtaining ions of platinum, iridium, palladium and gold, and its use in the sputtering mode ensures the absence of unwanted compounds which may cause contamination. Various modes of operation are described, the characteristics and some typical yields of the gun are given. Use in conjunction with an electrostatic lens, the ion beam may be readily focused to a 1 mm diameter spot. Author (NSA)

N70-38449# Florida State Univ., Tallahassee. Tandem Accelerator Lab.

TANDEM ACCELERATOR PROGRAM Final Report, 1 Oct. 1968 - 30 Sep. 1969

R. H. Davis and N. P. Heydenburg Feb. 1970 61 p refs

(Grant AF-AFOSR-1674-69)

(AD-707547; AFOSR-70-0915TR) Avail: CFSTI CSCL 20/7

The document describes the operation of the EN Tandem Van de Graaff accelerator and its instrumentation. Progress reports on the nuclear physics research are included. TAB

N70-38495# Office of Naval Research, London (England).

ANGLO-DUTCH SYMPOSIUM ON ENVIRONMENTAL ENGINEERING: THE EUROPEAN CONTRIBUTION

William E. Jahsman 7 May 1970 9 p

(AD-706323; ONRL-C-14-70) Avail: CFSTI CSCL 14/2

Organized by the English and Dutch environmental engineering societies (Society of Environmental Engineers and Sectie Milieutechniek, Kivi), the Symposium was held April 1-3, 1970 in the Aula (auditorium building) on the campus of the Dutch University of Technology. Fifteen papers on topics in environment descriptions and specifications, testing, and analytical and experimental tools were presented; and exhibits of measuring, recording and testing equipment were also provided. Author (TAB)

N70-38510# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

INVESTIGATION OF THE SIMULTANEOUS WORK OF THE SPUTTER-ION PUMP, NEM-300 WITH THE VAPOR-OIL UNIT, VA-05-4 AND VN-2 PUMP [ISSLEDOVANIE SOVMESTNOI RABOTY VAKUUMNOGO TITANOVOGO ELEKTRORAZRYADNOGO NASOSA NEM-300 S NAROMASLYANYM AGREGATOM VA-05-4 I NASOSOM VN-2]

O. D. Pronin and V. G. Pogozinskii 1969 17 p refs In RUSSIAN

(IFVE-SKU-69-39) Avail: AEC Depository Libraries

This paper presents the results of an investigation of the simultaneous work of the sputter ion pump NEM-300 and the vapor-oil unit VA-05-4 and VN-2 pump with one-way traps. It is shown that about 75% of the hydrocarbon, that slows down the pumping speed of the NEM-300 pump approximately two times, is present in the residual gas. After NEM-300 has worked with the air flux under the pressure of 0.00001 to 0.00002 torr during 20 to 30 minutes, the pumping speed restores and indicates that the pump is cleaned with an intense charge and the pump heating. After 24 hours of pump operation at a pressure of less than 1×10 to the minus 7th power to 1×10 to the minus 6th power torr, the pumping speed decreases due to the contamination of the hydrocarbon vapor from the vacuum chamber. Author (NSA)

N70-38521# European Organization for Nuclear Research, Geneva (Switzerland).

PROJECT FOR THE SLOW EJECTION SYSTEM FOR THE 70 GeV IHEP ACCELERATOR [PROJET DE SYSTEME D'EJECTION LENTE DE L'ACCELERATEUR DE GEV L'IFVE]

K. P. Myznikov et al Feb. 1970 21 p refs Transl. into FRENCH from Russian report In FRENCH

(CERN-Trans-70-3) Avail: AEC Depository Libraries

The system described is designed for the slow ejection of a proton beam having an energy of 20 to 70 GeV from the IHEP accelerator. The ejection of the protons is carried out with a plateau of the magnetic cycle having a maximal duration of 1.5 s. The ejection system is based on the resonant excitation of radial betatron oscillations. It is found preferable to use a nonlinear third-order resonance. The diagram of the slow ejection system is shown, and the basic parameters of the elements of this system are given. NSA

N70-38553# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

ION IMPLANTATION TARGET STAGE FOR AN ELECTROMAGNETIC ISOTOPE SEPARATOR

J. H. Freeman and G. A. Gard Mar. 1970 15 p refs

(AERE-R-6330) Avail: AEC Depository Libraries; HMSO: 4s 6d; BIS $0.90

The implantation target assembly of the Harwell Mk I isotope separator is described. The stage extends the energy range for singly charged ions from 40 to 140 keV and facilitates the precise alignment of single crystal samples to the ion beam for channelling studies. It is fitted with a vacuum lock for the rapid change of specimens and has provision for sample heating during implantation. Two interchangeable accelerating lenses are described and the computed beam trajectories compared with the observed focussing effects. Despite some loss of uniform beam area and angular definition at the highest voltages the stage has provided a simple and reliable facility for a very wide range of both radioactive and stable ion doping experiments. In the period 1966 - 9 over 3000 samples have been implanted. The target stage has also been used for the production of characteristic radiation damage patterns of crystal structure. Author (NSA)

N70-38597# National Accelerator Lab., Batavia, Ill.

THE MAIN-ACCELERATOR PROTOTYPE OPERATES Monthly Report

F. T. Cole 31 Mar. 1970 8 p Presented at the Natl. Accelerator Lab. Users Conf., Batavia, Ill., 10 - 11 Apr. 1970 Sponsored by AEC

(NAL-40) Avail: CFSTI

Prototype operation, construction progress, and the status of the linac, booster, main accelerator, and experimental facilities are outlined. NSA

N70-38675* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE SIMULATOR Patent
Melvin N. Wilson, Jr. and Carl Thiele, inventors (to NASA) Issued 8 Jun. 1965 (Filed 9 Nov. 1961) 8 p Cl. 73-432 Sponsored by NASA
(NASA-Case-XNP-00459; US-Patent-3,187,583; US-Patent-Appl-SN-180384) Avail: US Patent Office CSCL 14B

A test chamber dimensioned to receive a space vehicle model is maintained under conditions of high vacuum and low temperature while the model is subjected to simulated solar radiations. The optical system is arranged to transmit radiations of appropriate wave length from a plurality of external sources, through a test chamber wall, in such a manner that substantially uniform distribution is effected throughout the test region. The simulator utilizes a parabolic main reflector substantially coextensive with one end of the test chamber and a mating multiple cell reflector within the test chamber. The sum of the radiations from the external sources are distributed over the multiple cell reflector, and each cell reflects the radiations which it receives over essentially the entire surface of the main reflector. The radiations received at any point on the main reflector are the sum of the reflections from all the cells of the multiple cell reflector. Therefore, the radiations transmitted by the main reflector tend to be uniform. The space simulator is particularly adapted to produce radiations simulating the high intensity solar radiations believed to exist in the region of Venus. P.A.B.

N70-38727# Congress. House. Committee on Science and Astronautics.
FUTURE UTILIZATION OF THE KENNEDY SPACE CENTER, CAPE KENNEDY, FLORIDA
Washington GPO 1970 60 p Presented by the Comm. on Sci. and Astronautics of the 91st Congr., 2d Sess., No. 20, Brevard, Fla., 1 Apr. 1970
Avail: Subcomm. on Manned Space Flight

The hearings concerning the future utilization of the Kennedy Space Center for the space shuttle program are reported. The program objectives, the relationship to existing flight systems, and the mission capabilities are discussed. The extensive industrial capabilities and facilities for space programs existing at the center are also discussed. F.O.S.

N70-38976*# Avco Corp., Wilmington, Mass. Government Products Group.
A STUDY OF DYNAMIC LOAD SIMULATORS FOR ELECTRICAL SYSTEMS TEST FACILITY Final Report, 29 Dec. 1969 - 30 Jun. 1970
K. P. Joncas 17 Aug. 1970 154 p refs
(Contract NAS9-10429)
(NASA-CR-108624; AVSD-0364-70-RR) Avail: CFSTI CSCL 14B

The dynamic load simulator study was undertaken to identify and investigate: (1) methods of interrogating electrical hardware to establish significant characteristics; and (2) methods of simulating both the dynamic and steady-state responses of that hardware. In the proposed concept the individual loads to be simulated are first interrogated electrically (electronically) to identify quantitatively the parameters necessary to establish the load response to the power input. This data is then processed to yield the information required to program the simulator to respond to the power input in a like manner. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-37620# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
LOW DENSITY HIGH TEMPERATURE GAS DYNAMICS Final Report, 1 Nov. 1968 - 31 Oct. 1969
Jean J. Smolderen and J. F. Wendt 30 Nov. 1969 17 p refs
(Grant AF-EOAR-0055-69)
(AD-706906; AFOSR-70-1527TR) Avail: CFSTI CSCL 20/4

Surface pressures on a flat plate with sharp leading edge were measured in a M = 1.5 monatomic gas flow. The results were in essential agreement with those recorded for a diatomic gas, but differed quantitatively from a recent theory based on a discrete ordinate solution of the BGK equation. The modulated hot-wire probe was proven conclusively to provide a measurement of local mass flux in a hypersonic flow. Surveys performed in a low density free jet showed very clearly the initial disturbance produced by the thick surrounding shock structure. The upstream influence of a sharp flat plate was measured with the modulated hot wire probe. The disturbance field was symmetrical about the leading edge and extended upstream for approximately three mean-free-paths based on a body-free stream collision. Thermographic phosphors were determined to exhibit a sensitivity of 8% change in output light intensity per deg C and to have an equivalent noise figure of 0.1C; thus they will be suitable for measuring local surface temperature at sharp leading edges. Author (TAB)

N70-37647# Sandia Corp., Albuquerque, N.Mex.
AN EXPERIMENTAL INVESTIGATION OF THE STABILITY OF A THIN LIQUID LAYER ADJACENT TO A SUPERSONIC AIR STREAM
B. W. Marshall and W. S. Saric [1969] 9 p Sponsored by AEC
(SC-DC-69-2130) Avail: CFSTI

Studies were conducted on the feasibility of using a transpiration cooling system on reentry vehicles to insure the maintenance of vehicle geometry and structural integrity. The technique consists of injecting a liquid coolant in the stagnation region of a body and allowing the liquid to flow back over the body, providing a protective layer. An experimental study to investigate the interface response of a thin liquid layer with supersonic air flow over the surface was performed. The results show the dependence of the character of the surface and waves on the liquid layer parameters. R.B.

N70-37649# Montana State Univ., Bozeman. Engineering Research Labs.
AN INVESTIGATION OF TURBULENT FLOW IN A ROUGH PIPE Final Report
Harry W. Townes 16 Feb. 1970 57 p refs
(Contract AT(45-1)-1954)
(RLO-1954-3) Avail: CFSTI

Fully-developed turbulent flow in both smooth- and rough-walled pipes was investigated for Reynolds numbers from 30,000 to 480,000. The values of mean velocity, root-mean-square values of the turbulent velocity components, and corss-correlation values of the fluctuating velocities are presented for flow in a smooth pipe and two sand-roughened pipes. The experimental measurements for flow in smooth pipes are in good agreement with those of previous investigations throughout the Reynolds number range considered. For rough pipes, the measured UV cross-correlation values approach those predicted empirically from the Reynolds equations for fully developed, axisymmetric flow as the flow approaches the hydraulically smooth case. However, as the Reynolds number is increased and the flow proceeds through the transition region from smooth to fully rough flow and into the fully rough flow region, the values of the UV cross correlation in rough pipes are significantly lower than the predicted values. Author

N70-37667# Boeing Scientific Research Labs., Seattle, Wash.
INSTABILITY OF A TWO-DIMENSIONAL COMPRESSIBLE JET
C. H. Berman and J. E. Flowcs Williams Jan. 1970 21 p refs
(AD-707257; D1-82-0952) Avail: CFSTI CSCL 20/1

A linearized analysis of the two-dimensional double vortex sheet model of a jet shows that inviscid jet instabilities occur over a wide range of frequencies at all jet Mach numbers. No particular frequency for maximum growth rate exists unless finite shear layer thickness effects are considered. It is suggested that the model describes the essential characteristics of a real jet disturbed by long wavelength perturbations. The idea is advanced that the jet flow constitutes a broad band amplifier of high gain. Disturbances can grow rapidly to a size when non-linear effects bring about significant interaction with the mean flow. By seeding the jet with disturbances of a type that are highly amplified it is argued that gross features of the flow may be affected and that the jet may be rendered less noisy at high Mach number. It is argued that some of these ideas are supported by the observation that a supersonic jet diffuses at an unusually rapid rate when subject to the oscillatory condition known as screech. Author (TAB)

N70-37765# Michigan Univ., Ann Arbor. Computer, Information and Control Engineering.
A SUFFICIENCY CONDITION FOR DISCRETE TIME OPTIMAL PROCESSES Interim Report
N. Harris Mc Clamroch May 1970 10 p refs
(Grant AF-AFOSR-1767-69)
(AD-706393; AFOSR-70-1289TR) Avail: CFSTI CSCL 12/1

Sufficient conditions for optimality of a class of linear discrete time processes are presented. In distinction to previously obtained necessary conditions for optimality, these sufficient conditions hold under very weak hypotheses. An example, which might arise in a sampled data system, is presented. For the example the sufficient conditions yield the optimal control, but the necessary conditions are not applicable as the required hypotheses are not satisfied. Author (TAB)

N70-37811 Houston Univ., Tex.
MECHANISM OF ULTRASONIC CAVITATION NUCLEATION BY QUANTIZED VORTICES
Philip Michael McConnell (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-18647

The interaction between an ultrasonic field and one or a few quantized vortex lines in helium 2 was investigated using the audible cavitation threshold as a means of detection. Experiments were conducted with dual shafts, with and without paddles immediately above the sound field, rotating at various speeds in the same and opposite senses to induce superfluid vorticity. Rotation of a cylindrical bucket was also studied. Large samples of audible threshold measurements were taken and the values found to fluctuate with time in a cyclic manner both with and without rotation. Histograms of threshold events were not Gaussian but appeared to be bimodal. The higher modal value was most frequent without rotation and the lower was more or most frequent with rotation. The results are consistent with single vortex nucleation of cavitation and are discussed accordingly. The possibility of growth of the core under ultrasonic stimulation is suggested as a mechanism by which such a process could occur. Dissert. Abstr.

N70-37812*# UNIDEV, Inc., Huntsville, Ala.
ON THE MOTION OF LIQUIDS ENCLOSED IN AEROSPACE VEHICLE TANKS UNDER WEAK GRAVITATIONAL FIELDS. VOLUME 1: THEORETICAL CONSIDERATIONS
L. L. Fontenot Mar. 1970 110 p refs
(Contract NAS8-21272)
(NASA-CR-113117; UR-00010-Vol-1) Avail: CFSTI CSCL 20D

The complete equations of motion of an aerospace vehicle with partially liquid-filled cavities are derived, and the contributions of the liquid motions to the overall system motion are defined. The vehicle is slightly disturbed from an assumed reference state of motion, and the small perturbation equations of motion derived. The contributions of the small liquid motions to the overall perturbation vehicle motion are defined and isolated. Using boundary layer and perturbation theory, the behavior of a liquid enclosed in a tank undergoing planar motion is determined. The fundamental results constitute a first order correction of the high-g theory. The equations are specialized to rotationally symmetric vessels, wherein the axis of symmetry coincides with the vehicle acceleration vector, and then cast in a form suitable for digital implementation. The forces, moments, and free boundary displacement are given in terms of nondimensional coefficients, which are expressible by means of the geometry of the vessel, properties of the liquid, contact angle, and parameters associated with the high-g eigenoscillation problem. Author

N70-37813*# UNIDEV, Inc., Huntsville, Ala.
ANALYSIS OF FLUID SLOSHING IN ARBITRARY TANKS HAVING ROTATIONAL SYMMETRY: A CORRECTION FOR LOW GRAVITY CONDITIONS. VOLUME 2: COMPUTATIONAL APPLICATION
T. S. Chandler and D. O. Lomen Mar. 1970 114 p refs
(Contract NAS8-21272)
(NASA-CR-102732; UR-00011-Vol-2) Avail: CFSTI CSCL 20D

The existing program was modified to accept the equations which describe the liquid sloshing. Three new routines were added and the matrix routine was modified. Gauss's quadrature method was used as the integration scheme and was written as a new routine. Author

N70-37821# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
COAXIAL TURBULENT JETS
F. H. Champagne and I. J. Wygnanski Feb. 1970 47 p refs
(AD-707282; D1-82-0958) Avail: CFSTI CSCL 20/4

The flow field generated by two coaxial jets was investigated experimentally with hot-wire anemometers. The area ratio between the external and internal nozzle was varied as well as the velocity issuing from each of the nozzles. The distribution of the mean velocities, turbulence intensities, and shear stresses were determined for the various cases. The development of the flow field and its approach to a self-preserving state is discussed. The Reynolds numbers based on the nozzle diameters varied from 0 to 100,000 and the velocities were low enough that the flow can be considered incompressible. Author (TAB)

N70-37848# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF CAVITATION AND GAS DIFFUSION IN A FLOW
10 Aug. 1970 17 p refs Transl. into ENGLISH from Russian articles
(JPRS-51133) Avail: CFSTI

CONTENTS:

1. FORMATION OF CAVITATION IN A LIQUID A. S. Gorskov et al p 1–10 refs (See N70-37849 21-12)
2. DIFFUSION OF A DISSOLVED GAS IN A FLOW WITH A STATIONARY CAVITY A. S. Gorshkov p 11–15 refs (See N70-37850 21-12)

N70-37849# Joint Publications Research Service, Washington, D.C.
FORMATION OF CAVITATION IN A LIQUID

A. S. Gorshkov et al *In its* Develop. of Cavitation and Gas Diffusion in a Flow 10 Aug. 1970 p 1-10 refs Transl. into ENGLISH from Tr. Akust. Inst. (USSR), v. 6, 1969, p 30-38 (See N70-37848 21-12)
Avail: CFSTI

A research survey is given on cavitation strength in water and its measurement methods. The practical significance of the experimental results is assessed for the determination of origination conditions of cavitation in natural water basins and cavitation tubes. Author

N70-37850 # Joint Publications Research Service, Washington, D.C.
DIFFUSION OF A DISSOLVED GAS IN A FLOW WITH A STATIONARY CAVITY
A. S. Gorshkov *In its* Develop. of Cavitation and Gas Diffusion in a Flow 10 Aug. 1970 p 11-15 refs Transl. into ENGLISH from Inzh.-Fiz. Zh., Akad. Nauk Belorussk. SSR (Minsk), v. 13, no. 5, 1967 p 691-694 (See N70-37848 21-12)
Avail: CFSTI

A two-dimensional solution of discharging gas dissolved in a stationary cavity liquid; behind a symmetrical impediment in the Kirchhoff case of a zero cavitation number, is obtained using strict methods of mathematical physics. Author

N70-37912 Washington Univ., Seattle.
DROP FORMATION MASS TRANSFER
S. Mohan Rajan (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-18311

The mass transfer occurring between a liquid drop during its formation and the surrounding liquid phase was studied. The entire formation period was observed beginning with the residual quantity left at the nozzle upon detachment of the preceding drop and terminating with drop release. The variables investigated were nozzle diameter, dispersed phase flow rate, continuous phase Reynolds number, and the possible effect of a surface active agent. The results show that the mass transfer coefficient decreases monotonically with formation time during the initial phase of formation. Generally the coefficient continued to decrease throughout formation although in some runs there was a slight increase towards the end of formation. The mass transfer coefficients obtained in this study are an order of magnitude higher than those predicted for steady fall conditions in the same system. Dissert. Abstr.

N70-37942# California Univ., Berkeley. Div. of Aeronautical Sciences.
THE INFLUENCE OF A FREE SURFACE ON UNDERWATER SPHERICAL EXPLOSIONS
M. Holt and W. F. Ballhaus, Jr. Mar. 1970 49 p
(Contract N00014-69-A-0200-1020)
(AD-706341; AS-70-3) Avail: CFSTI CSCL 19/4

The flow field resulting from the rupture of a pressurized sphere at a small depth beneath the ocean surface is studied. Specifically, the positions on the axis of the underwater shock, the shock transmitted into air, the disturbed ocean surface, the head of the expansion wave reflected from the surface, and the gas-water contact front are determined as functions of time. The shape of the transmitted shock front and the disturbed ocean surface are also found for a given time. Solutions are obtained by integrating a set of first order ordinary differential equations numerically with respect to time. Calculations are carried out for a sphere of helium at a pressure of 10,000 atmospheres with a ratio of depth to initial sphere radius equal to three. Author (TAB)

N70-37945# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY Semiannual Technical Summary Report, Period Ending 28 Feb. 1870
Martin H. Bloom 28 Feb. 1970 14 p
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-706235; PIBAL-70-28) Avail: CFSTI CSCL 20/4

The report contains a compilation of abstracts of papers which were either accepted for publication or were published. The papers are on subjects of fluid dynamics, Electromagnetics and Plasmas. The summary also contains a listing of papers submitted to journals, lectures, internal reports and staff activities. Author (TAB)

N70-37952 Boston Univ., Mass.
NUMERICAL SOLUTION OF THE RAYLEIGH CELL PROBLEM
John Warren Royal (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-18784

A procedure is developed to find the solution of the equations describing two-dimensional flow of a viscous fluid, along with heat conduction and convection. Experimental and theoretical evidence of the existence of two-dimensional convection roll cells is cited. A numerical study is made of the motion of an initially motionless incompressible fluid between two horizontal plates with the upper one cooled and the lower one heated. This study is made by considering a single two-dimensional convection cell as a rectangle with the upper side cooled, the lower side heated, and the vertical sides insulated. The initial temperature is slightly perturbed from being linear in the vertical direction. The momentum, energy, state, and continuity equations are given along with appropriate initial and boundary conditions. The momentum equations are replaced by stream function and vorticity equations. All equations are in dimensionless form. Dissert. Abstr.

N70-37960# Franklin Inst., Philadelphia, Pa. Research Labs.
INERTIA AND ENERGY EFFECTS IN THE DEVELOPING GAS FILM BETWEEN TWO PARALLEL FLAT PLATES
H. G. Elrod, Jr. and T. Y. Chu May 1970 43 p refs
(Contract Nonr-2342(00))
(AD-707426; FIRL-I-C2429-3) Avail: CFSTI CSCL 13/9

Inertia and temperature effects in entrance flow between parallel flat plates are investigated by using both boundary layer theory and an approximate analysis. The approximate theory is implemented by a gas table similar to those for conventional Fanno-line computations. Author (TAB)

N70-37961 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF COMPRESSIBLE JET WALL ATTACHMENT AT LOW REYNOLDS NUMBERS
Daniel Charles Anderson, Jr. (Ph.D. Thesis) 1969 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-18608

Experiments were conducted for fixed values of Mach number and Knudsen number which was defined as the ratio of molecular mean free path at the jet nozzle exit to the nozzle exit width. A flow model one inch thick with 0.20 inch wide nozzle exit and an adjacent wall offset 0.30 inches from the nozzle lip and inclined at 10 deg to the nozzle centerline was constructed. Unattached jet velocity profiles and centerline velocity variations were obtained with the adjacent wall removed from the model. A correlation between centerline velocities and distance along the jet centerline was empirically developed. A very simple empirical correlation between unattached jet core length and attachment distance along the adjacent wall was developed. A simplified jet attachment model was proposed for estimating attachment distance. The model was found to agree well with experiments for both compressible and incompressible flow and a variety of wall geometries. Dissert. Abstr.

N70-38028# Naval Ship Research and Development Center, Washington, D.C.

FINITE-DIFFERENCE APPROXIMATIONS OF THE VORTICITY OF LAMINAR FLOWS AT SOLID SURFACES

Haris J. Lugt and Yermiyahu Rimon Apr. 1970 35 p refs

(AD-706328; Rept-3306) Avail: CFSTI CSCL 20/4

Finite-difference methods for solving the Navier-Stokes equations by means of the stream function-vorticity formulation require the computation of the vorticity on solid surfaces with the aid of one-sided difference schemes. Several such schemes of second-order accuracy in the vorticity are derived for asixymmetric flows in orthogonal coordinate systems. Their accuracies are examined by comparing the appropriate solutions with the exact values of flows past oblate spheroids for vanishing Reynolds numbers (Oberbeck solution). It is found that if exact values of the solution are used at the inner points, the various approximations of the surface vorticity differ considerably from each other, and that the main source of error is the use of numerical derivatives. However, if the various methods of computing the surface vorticity are incorporated in an overall numerical scheme, the distinctions among them are reduced considerably. Errors in the drag coefficients computed by the various methods are an order of magnitude smaller than those of the surface vorticity. Experiments with numerical stability reveal that the diffusion process near the solid surface dominates the numerical stability properties of the scheme used. Author (TAB)

N70-38051# Naval Research Lab., Washington, D.C. Ocean Structures Branch.

ON THE SHAPE OF A CABLE TOWED IN A CIRCULAR PATH

Richard A. Skop 24 Apr. 1970 32 p refs

(AD-706716; NRL-7048) Avail: CFSTI CSCL 13/10

The problem of determining the shape of a cable towed in a circular path is considered both by experimental and theoretical techniques. The equations of static equilibrium, referred to a rotating coordinate system, are derived and nondimensionalized to isolate the important parameters. Certain order-of-magnitude simplifications are obtained. The remainder of the study is restricted to cases where the effect of hydrodynamic drag is negligible. The experimental results indicate that for certain combinations of the governing parameters no stable equilibrium solution for the cable shape exists. Rather, at these combinations, the system is marked by a violent dynamic motion between two adjoining nodal configurations. To examine this phenomenon analytically, the static equations are idealized to a vacuous towing medium. It is shown that these equations possess several possible solutions. The questions of stability of equilibrium and onset of transition are resolved from these solutions by reference to the experimental observations. Since no drag forces are present in a vacuum, it is concluded that the centrifugal loading is the principal agent responsible for producing the unsteady dynamic behavior of the cable. Author (TAB)

N70-38092# Naval Ship Research and Development Center, Washington, D.C.

FLAT PLATE FRICTIONAL DRAG REDUCTION WITH POLYMER INJECTION Final Report

Justin H. McCarthy Apr. 1970 32 p refs

(AD-706327; Rept-3290) Avail: CFSTI CSCL 20/4

A method is developed for prediction of frictional drag reduction in high Reynolds number flows past smooth flat plates with polymer injection near the leading edge. Numerical results are given for water-Polyox WSR 301 solutions with either uniform concentration or injection. Author (TAB)

N70-38117# Toronto Univ. (Ontario). Inst. for Aerospace Research.

MECHANICS OF RAREFIED GASES

In its [Inst. for Aerospace Res.] Nov. 1969 p 5-9 ref (See N70-38116 21-01)

Avail: CFSTI

The experimental study of diffusive separation in transition-flow aerodynamic situations is reported. The motivation of the research is derived from from the need for a better and quantitative understanding of rocket borne mass spectrometers at relatively low altitude. To facilitate the laboratory work, argon-helium mixture were used because of their conveniently large mass differences. The optical - electron beam techniques of measuring gas composition were supplemented with a large-angle scattering apparatus to detect very small concentrations of argon in helium. In addition, it has given further and more detailed information about the operation of the optical technique. Additional instrumentation is under construction to measure flow velocity and temperature with the Doppler shift method. The theoretical work on computer experiments has resulted in programs applicable to fairly general flow situations. In addition, a skimmer problem was studied to illuminate the skimmer problem was studied to illuminate the skimmer interaction problem in further detail. The operation of the skimmer as a mass flow probe under transition flow conditions was also studied. The latter problem is of importance in the experimental program in the plasma tunnel where the mass flow probe is used as a primary instrument for the definition of hot plasma flows. The theoretical work on the collisionless aerodynamics of concave surfaces is nearing its completion. Author

N70-38156# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.

OPTICAL AND MICROWAVE MEASUREMENTS BEHIND SHOCK WAVES Final Scientific Report, 1 Nov. 1967 - 31 Oct. 1969

W. Low 30 Nov. 1969 46 p refs

(Contract F61502-68-C-0037)

(AD-704127; AFOSR-70-0984TR) Avail: CFSTI CSCL 20/4

Measurements of Mach speed, of optical emission and microwave attenuation on converging and diverging taper sections are reported. A detailed analysis of the shock flow of the transmitted, reflected and re-reflected waves is attempted. A comparison of the data with the various theories is given. Author (TAB)

N70-38187# Naval Ship Research and Development Center, Annapolis, Md.

THE MEASUREMENT OF FLUID FLOW USING NUCLEAR MAGNETIC RESONANCE AND RELAXATION

Henry Keith Whitesel (M.S. Thesis—George Washington Univ.) Apr. 1970 162 p refs

(AD-706348; NSRDL/A-6-88/69) Avail: CFSTI CSCL 20/4

A theoretical study was performed to determine the potential use of nuclear magnetic resonance (NMR) and relaxation for the measurement of fluid flow. The objective of the study was to relate the amplitude of the nuclear magnetization to the fluid velocity in circular pipes. Blochs equations were used in deriving the absorption/dispersion signals and the relaxation (free-induction) signal for moving fluids. The fluid velocity was related to the nuclear magnetization by equating time with the ratio of pipe length to velocity. Effects of the profile for both laminar and turbulent flow were included. Results included the following: The absorption and dispersion components are attenuated nonlinearly by the fluid velocity and are dependent on the type of flow. In general the same is true for free-induction magnetization. However, when a 90 deg d-c pulse of short time duration is used to rotate the nuclei, the free-induction magnetization becomes a linear function of velocity and insensitive to the flow profile. With the above result, a theoretical design of a free-induction, flow sensor was developed to be insensitive to the flow profile and the fluid parameters. Author (TAB)

N70-38245# Joint Publications Research Service, Washington, D.C.

FLUIDIC-PNEUMATIC APPARATUS

V. I. Chernyshev et al *In its* Pneumatic Automation and Local Control Systems Designs 20 Aug. 1970 p 1-9 refs (See N70-38244 21-10)

Avail: CFSTI

A method is presented for logic circuit construction in fluidics. Advantages over conventional methods include compatibility with fluidic technology, extensive use of passive fluidic elements, different signal level options, use of matching amplifier to organize multicycle logic and reduce circuit noise. These circuits are used for a certain class of pneumatic automation apparatus, particularly apparatus for cyclic pneumatic automation characterized by extensive input and output parameters. E.H.W.

N70-38315*# Techtran Corp., Glen Burnie, Md.

QUASI-ONE-DIMENSIONAL NOZZLE FLOWS WITH VIBRATIONAL AND DISSOCIATIONAL NON-EQUILIBRIUM [QUASI-EINDIMENSINALE DUESENSTROEMUGEN MIT SCHWINGUNGSNICHTGLEICHGEWICHT UND RELAXIERENDER DISSOZIATION]

K. Robert Washington NASA Aug. 1970 46 p refs Transl. into ENGLISH of West German report DLR-FB-70-01, Jan. 1970 p 1-55

(Contract NASw-2037)

(NASA-TT-F-12947; DLR-FB-70-01) Avail: CFSTI CSCL 20D

A computational method is developed for dealing with steady diatomic gases with vibrational and dissociational nonequilibrium. Integration starts at the frozen sonic point and is perfomred independently upstream and downstream. After some general theoretical considerations a program for numerical computation is given. Typical results for nitrogen are discussed. Whereas the axial dependence of velocity, pressure, and density is monotonous, the temperature has a maximum in the convergent nozzle portion. Vibrational energy and degree of dissociation, freeze, immediately downstream of the sonic point. Author

N70-38316# Watervliet Arsenal, N.Y. Benet Research and Engineering Labs.

TWO-FLUID FLOWS IN FACE SEALS

John E. Zweig (Ph.D. Thesis—Rensselaer Polytech. Inst.) Apr. 1970 158 p refs

(AD-706841; WVT-7014) Avail: CFSTI CSCL 11/1

The laminar flow of two dissimilar fluids in an aligned, parallel surface face seal is studied analytically. It is assumed that in the space between the seal faces there are two different constant property fluids separated by an identifiable interface. Velocities and the dominant components of shear stress are matched across this interface. The general two-fluid results are applied to various combinations of water, oil, and air in the reservoirs inside and outside the seal. Performance characteristics of these combinations are presented graphically, along with a discussion of the operating conditions for which no solutions were obtained. Author (TAB)

N70-38340# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.

ON THE INTERACTION BETWEEN CHEMICAL KINETICS AND GAS DYNAMICS IN THE FLOW BEHIND A CYLINDRICAL DETONATION FRONT

Suryanarayaniah Rajan Aberdeen Proving Ground, Md. BRL Mar. 1970 120 p refs

(Contract DA-18-001-AMC-1016(X))

(AD-706850; BRL-CR-9) Avail: CFSTI CSCL 20/4

The interaction of chemical kinetics and heat release phenomena with the gasdynamics of the flow appreciably alters temperature, density, and flow velocity behind the incident shock wave. This in turn influences the strength and decay rate of the shock at later times. The detonation cell geometry and spacing are thus dependent upon the nonsteady kinetic rate processes in the shocked gas. Overall effects of the chemical processes for the H2-O2 system are strongly influenced by initial pressure and, to a lesser degree, gas composition. Author (TAB)

N70-38492# Advisory Group for Aerospace Research and Development, Paris (France).

ENGINEERING ANALYSIS OF NON-NEWTONIAN FLUIDS

Donald C. Bogue (Tenn. Univ., Knoxville) and James L. White (Tenn. Univ., Knoxville) Jul. 1970 106 p refs

(AGARDograph-144-70) Avail: CFSTI

The fundamentals of rheology are reviewed, including viscometry theory and practice and rheological equations of state. The rheological properties of fluids are discussed for suspensions and for polymeric materials. Flow problems of non-Newtonian fluids in different geometries are considered with special application to industrial problems, including theoretical hydrodynamics, dimensionless groups and scale-up, flow through tubes, and exit flows and extrudate swelling. Applications in polymer processing are discussed for three operations: screw extrusion, milling and calendering, and melt spinning. Non-Newtonian fluid turbulent flow is also considered. Extensive bibliographies are included. P.A.B.

N70-38514# Technion-Israel Inst. of Tech., Haifa. Dept. of Mechanics.

CROSS STRESSES IN THE FLOW OF GASES Final Scientific Report, 1 Dec. 1966 - 31 Aug. 1969

Markus Reiner and Amon Foux Jan. 1970 44 p refs

(Contract F61052-67-C-0037)

(AD-706099; TDM-70-2) Avail: CFSTI CSCL 20/4

When gas is sheared in torsional flow between two discs, one stationary and the other rotating, and when the distance between both discs is very small so that the velocity gradient is large, then the gas is drawn inside between the discs and a thrust bearing pressure is developed between them. The pressure at the centre of rotation, determined experimentally, was found to be independent of the speed of rotation and of the thrust on the rotating disc; its value was equal to the ambient pressure of the instrument. The values of the rigidity parameters of the gas were calculated. Author (TAB)

N70-38515# Hydronautics, Inc., Laurel, Md.

PENETRATION OF A DENSITY DISCONTINUITY BY A TURBULENT VORTEX-PAIR

J. L. Birkhead, J. Shwartz, and M. P. Tulin Dec. 1969 41 p refs

(Contract Nonr-3688(00))

(AD-706785; TR-231-21) Avail: CFSTI CSCL 20/4

Studies were carried out concerning the penetration of an isolated, rising fluid mass through a density discontinuity, such as may exist in the atmosphere (the tropopause) and in the oceans (the thermoclines). The rising mass was two-dimensional, turbulent, and had the characteristic shape and internal motions of a vortex-pair, or thermal. An analysis of the pairs motion through a density discontinuity, based on the conservation laws for volume, buoyancy and energy, reveals that the maximum rise of the vortex-pair above the density interface is proportional to the square root of its characteristic densometric Froude number. Model experiments, carried out in a stratified, two-layer, saline-water tank, with thermals impinging on the density interface, have clearly confirmed this conclusion. The densometric Froude number is defined in this case as the product of the vortex-pairs density and the square of its velocity, divided by the gravitational acceleration, the density difference of the two fluid layers and the pairs radius, all taken at the point where the pair first impinges on the density discontinuity. Author (TAB)

N70-38562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAS COMPRESSIBILITY ON THE TRANSITION OF A LAMINAR BOUNDARY LAYER INTO A TURBULENT ONE
L. P. Kozlov 3 Feb. 1970 10 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. SSR, Ser. A, Fizyko-Tekhn. ta Mat. Nauky (Kiev), v. 31, no. 3, 1969 p 239-243
(AD-706181; FTD-HT-23-630-69) Avail: CFSTI CSCL 20/4

By using the hydrodynamic model of finite perturbations, the phenomenological theory is developed for the laminar boundary layer transition into a turbulent boundary layer on a surface with an arbitrary pressure gradient distribution on the external boundary of the layer in compressible gas. A new dependence of the critical Reynolds number in the transition point from the initial turbulence of the running flow relative to roughness and Mach number is obtained in an analytical form. This dependence is in good agreement with the known experimental data. Author (TAB)

N70-38655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE METHODS OF CALCULATING THE DISTRIBUTION OF VELOCITY WITH ALTITUDE DURING THE BRAKING OF BODIES IN THE ATMOSPHERE
O. A. Privarnikov 29 Jan. 1970 12 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 13, 1968 p 10-15
(AD-706171; FTD-HT-23-602-69) Avail: CFSTI CSCL 20/4

The problem of determining the velocity distribution with respect to the altitude of a body falling free in the atmosphere from an altitude is considered. Expressions are derived for the velocity distribution and braking coefficient. Approximate methods for calculating velocity distribution are outlined for two cases when: (1) the wave drag coefficient is constant; and (2) the wave drag coefficient varies as a function of M and flight altitude. The cases of vertical and ballistic trajectories are considered. It is shown that beginning with the value of the braking coefficient the landing velocity depends weakly upon the initial conditions and is determined by the braking coefficient. TAB

N70-38683# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Karlsruhe (West Germany).
SOLUTION OF THE THREE-DIMENSIONAL TIME-DEPENDENT NAVIER-STOKES EQUATIONS BY THE DIFFERENCE METHOD [DIE LOESUNG DER DREIDIMENSIONALEN INSTATIONAEREN NAVIER-STOKES-GLEICHUNGEN MIT DEM DIFFERENZENVERFAHREN]
Willi Schoenauer (Ph.D. Thesis - Karlsruhe Univ.) Apr. 1970 135 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-15) Avail: CFSTI; ZLDI Munich: 28,90 DM

The solution of the three-dimensional time-dependent Navier-Stokes equations for high Reynolds numbers by the difference method was examined theoretically and by numerical experiments. The structure of the Navier-Stokes equations leads to the condition that the space mesh size must be of the order of 1/Reynolds number. Consequently the Navier-Stokes equations cannot be solved numerically even by the fastest available computers for Reynolds numbers in the turbulent regime. Author (ESRO)

N70-38697 Michigan Univ., Ann Arbor.
ON FLUCTUATION-DISSIPATION THEOREMS AND THEIR APPLICATIONS AND ON BURGERS' TURBULENCE MODELS
Shiu-Chu Chiu (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-17981

The fluctuation-dissipation theorems connecting the correlations of macroscopic quantities and the linear phenomenological coefficients are derived for the relaxation functions and the response functions using perturbation theory. The stationary correlations of macroscopic quantities such as density, entropy etc., are calculated for the Navier - Stokes equations; they are delta-functions in space and are independent of viscosity and thermal conductivity. The same calculations are carried out for the Krook Model. Both the stationary and the spectral correlations of charge densities etc., are calculated for the Vlasov plasma. The spectral correlations of electromagnetic fields and the energy spectrum are calculated for a cavity with an absorbtive medium. The stabilities and transitions of the solutions of the Burgers' Models of turbulence are considered near the critical points. Dissert. Abstr.

N70-38730# Naval Ordnance Lab., White Oak, Md.
STABILITY OF A VISCOUS JET, NEWTONIAN LIQUIDS
Ralph E. Phinney and Waymon Humphries 7 Jan. 1970 67 p refs
(AD-707320; NOLTR-70-5) Avail: CFSTI CSCL 20/4

An experimental investigation of stability is made of laminar viscous jets of a Newtonian fluid. The breakup length is measured by electrical means as a function of fluid properties, together with jet exit velocity and diameter. Nozzles with orifice plate exits, as well as long, cylindrical pipes, were tested. The conditions for the maximum breakup distance were determined, as well as the functional form of the breakup curve before and after the peak. The results are discussed in comparison to the other known sources of data, as well as the theories which are applicable. Author (TAB)

N70-38779 California Univ., Davis.
A LAGRANGIAN WIENER-HERMITE EXPANSION FOR TURBULENCE
Gregory Harger Canavan (Ph.D. Thesis) 1969 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00

Wiener proposed that the turbulent velocity be expanded in Hermite functionals of a Gaussian white noise base advected by the fluid. The mechanics of converting the suggestion into approximation for incompressible, homogeneous, and isotropic turbulence are presented. Computability dictates that the expansion be truncated to two terms. The projected equations for the Lagrangian expansion are shown to possess several important consistency properties: they conserve energy by nonlinear interaction, preserve the inviscid equipartition ensemble, and are invariant to random Galilean transformations. Though a Wiener-Hermite expansion cannot provide an approximation which dissipates fluctuations about the equipartition solution, the use of an advected base is shown to largely overcome the deficiencies which render low-order truncations of fixed base expansions invalid as approximations to high Reynolds number turbulence. Dissert. Abstr.

N70-38784 Michigan Univ., Ann Arbor.
TWO STUDIES IN FLUID MECHANICS
Charles Ewing Hickox, Jr. (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-18022

Two investigations, one concerned with the stability of stratified pipe flow and the other with finite amplitude waves in a swirling flow, are presented. In the first part, the stability of a steady, axisymmetric, laminar, primary flow composed of two fluids flowing concentrically in a straight circular tube is considered. The fluids have different densities and viscosities and are assumed to be incompressible and nondiffusive. An interface between the two fluids exists at a prescribed radial distance from the axis of symmetry. Surface tension effects at the interface are taken into account. It

is demonstrated that, regardless of the size of the Reynolds number, no situations are encountered for which the primary flow is stable to asymmetric and symmetric disturbances, simultaneously. In the second part, the existence of waves of finite amplitude and permanent form in steady, axisymmetric, swirling flow of an inviscid, incompressible fluid contained in a straight circular tube is demonstrated. The type of waves found corresponds to the classical solitary and conoidal waves investigated by Korteweg and de Vries. Dissert. Abstr.

N70-38786# Georgia Inst. of Tech., Atlanta. Coll. of Engineering.
SEMINAR PROGRAM (1969 - 1970) IN SOLID AND FLUID MECHANICS Summary Report
1 Jun. 1970 43 p refs Sponsored by Humble Oil Educ. Found.
Avail: CFSTI

Selected abstracts are presented for a lecture series in solids and fluid mechanics during 1969 and 1970. The subject areas included dynamics and vibrations, structural mechanics, mathematical and computer methods of analyzing structural problems, mechanics in ecological systems, rocket engine ignition, earthquake resistance of structures, gas-liquid and liquid-solid two-phase flow, mechanics problems in bioengineering, fluid mechanics of lake circulation, electrohydrodynamics of suspensions, and laminar-turbulent transition. R.B.

N70-38794# RAND Corp., Santa Monica, Calif.
A FAMILY OF SIMILARITY FLOWS WITH VORTEX SHEETS
R. C. Alexander May 1970 34 p refs
(AD-707036; P-4371) Avail: CFSTI CSCL 20/4

Prandtls two-dimensional, time-dependent similarity solutions are corrected and extended to cases of N-branched vortex sheets possessing a certain central symmetry. For both N = 1 (Prandtls case) and N = 2 it is found that the similarity parameter m is restricted to the range m = or < 1/2. When N = 1 multiple solutions are found for a given value of m provided the absolute value of m is sufficiently small compared to one. A property of these multiple solutions is that the tangential velocity to the concave side of a vortex sheet is O(exp(-4 pi)) smaller than the tangential velocity to the convex side. All values of m are found to be admissible for the case N = 3. In all cases it is found that certain features of the flows resemble a classical (but time-dependent) circular vortex. For example, it is found that the circulation in a disk of radius r is proportional to r squared. There are also important differences. The flow fields for N = 1, 2, and 3 are described in some detail. Author (TAB)

N70-38796*# Hydronautics, Inc., Laurel, Md.
EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS ON MULTIPLE LIQUID IMPACT EROSION
A. Thiruvengadam, S. L. Rudy, and M. Gunasekaran Washington NASA Sep. 1970 85 p refs
(Contract NASw-1608)
(NASA-CR-1638; Rept-719-2) Avail: CFSTI CSCL 20D

Research on the impact erosion of 1100-O Aluminum, 316 stainless steel, commercially pure annealed nickel and annealed 6Al-4V titanium is reported. The erosion is caused by multiple impacts with a water jet in a rotating disk facility. Relationships between the velocity of impact and the number of impacts at which visible indentations were observed are compared with the high frequency fatigue strength of these materials. Experimentally observed rates of erosion are compared with a recently developed theory of erosion, and with the fatigue life measurements. The peak rate of erosion varies approximately as the fifth power of the velocity of impact. The time to reach the peak rate varies as the one-fifth power of the velocity. Cavitation erosion strengths and liquid impact erosion strengths are also compared. Author

N70-38997* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SLOSH SUPPRESSING DEVICE AND METHOD Patent
Werner R. Eulitz, inventor (to NASA) Issued 12 Nov. 1963 (Filed 10 Aug. 1962) 8 p Cl. 137-1
(NASA-Case-XMF-00658; US-Patent-3,110,318; US-Patent-Appl-SN-216710) Avail: US Patent Office CSCL 20D

A method for slosh suppression and pressure decay obviation is described for use in liquid propellant vehicle propellant containers. The invention is predicated upon a wave interference principle, in which sloshing is damped by the excitation of counter oscillations within a liquid bulk to consume the energy of the liquid in motion by superposition. Tubes are immersed in the liquid in such a manner as to excite liquid oscillations within the tubes of substantially the same amplitude but of a different phase from that without the tube. Immersion is to a depth of one quarter to one half the container diameter, and the tubes are moveable relative to the container side in response to the container liquid level. A bell-like member with bouyancy means, having a single degree of freedom in mobility, can also be positioned in the tank; this modification has the advantage of covering practically the total liquid surface, substantially eliminating pressure decay. P.A.B.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-37629# Naval Postgraduate School, Monterey, Calif.
COLLECTION AND CHARACTERIZATION OF THE SURFACE FILM OF WINDROWS IN MONTEREY BAY
James Ronald Reed (M.S. Thesis) Jun. 1969 39 p refs
(AD-706699) Avail: CFSTI CSCL 8/10

A surface film collector was constructed and used to collect the surface film of windrows. The surface film was shown to be a complex mixture of primarily unsaturated esters of variable biological origin. Infrared, visible, and ultraviolet spectra are included. Author (TAB)

N70-37651# California Univ., Los Angeles. Dept. of Geology.
CHEMICAL COMPOSITION OF OCEAN USING A DIRECT MEASURING OCEANOGRAPHIC ELECTROCHEMICAL PROBE Annual Progress Report
I. R. Kaplan and S. Ben-Yaakov 1970 40 p refs
(Contract AT(04-3)-34)
(APR-1; UCLA-34-P-178-X-1) Avail: CFSTI

Research progress is reported on development of an instrumentation system, laboratory studies on the solubility of CaCO3 in seawater, laboratory studies on sulfide measurements in sea water with a sulfide electrode, and in situ ocean experiments. Author

N70-37719# University Coll., London (England). Dept. of Physics.
DETERMINATION OF THE STRUCTURE OF THE ATMOSPHERE BETWEEN 90 AND 250 KILOMETERS USING CONTAMINANT RELEASES. 1: WOOMERA, MAY 1968
David Rees, Robert G. Roper (Weapons Res. Estab.), Keith H. Lloyd (Weapons Res. Estab.), and Colwyn H. Low (Weapons Res. Estab.) Jan. 1970 83 p refs Prepared in cooperation with Weapons Res. Estab., Salisbury, Australia
(Contract F61052-68-C-0057)
(AD-707133; AFCRL-70-0288; SR-1) Avail: CFSTI CSCL 4/1

The paper presents the results of the analysis of contaminant

releases made from two Skylark rockets fired on the morning and evening of 31st May, 1968. The wind profile, turbulent structure, temperature, and density of the atmosphere were determined. The significance of the results is discussed, in particular the diurnal variation. Some comments are made relating our observations to previous results - both of other workers and our own. Author (TAB)

N70-37731# Air Force Cambridge Research Labs., Bedford, Mass. Optical Physics Lab.
VERTICAL-ATTENUATION MODEL WITH EIGHT SURFACE METEOROLOGICAL RANGES 2 TO 13 KILOMETERS
Louis Elterman Mar. 1970 67 p refs
(AD-707488; AFCRL-70-0200; ERP-318) Avail: CFSTI CSCL 4/1

An examination of the haze regime shows that: (1) the aerosol properties of a surface meteorological range generally affect a mixing layer to 5 km altitude, and (2) the lower and upper visibility limits of a haze regime are defined by meterological ranges 1.2 km and 15 km respectively. Within these limits eight meteorological ranges are selected for developing uv, visible, and ir aerosol attenuation coefficients. An aerosol scale height is derived for each meteorological range. Finally, the computed aerosol attenuation coefficients are presented as tabulations which include previously published attenuation parameters (aerosols, molecules and ozone) to 50 km altitude. Author (TAB)

N70-37743# Naval Postgraduate School, Monterey, Calif.
NUMERICAL CALCULATIONS OF STRATOSPHERIC OZONE TRANSPORT
Richard Henry Stender (M.S. Thesis) Oct. 1969 73 p refs
(AD-706724) Avail: CFSTI CSCL 4/1

The vertical distribution of ozone was observed by the Air Force Cambridge Research Laboratories North American ozonesonde network from 29 April 1963 to 10 May 1963 on a daily basis. This observed data, supplemented by twenty-four hour trajectory calculations, was used to prepared distributions of ozone mixing ratio on the 200, 100, 50, and 30 mb surfaces. The ozone distributions were evaluated for the ozone transport by mean and eddy motions in the lower stratosphere. The results of these calculations show the magnitude of the horizontal and vertical transport of ozone into and out of the 30/50, 50/100, and 100/200 mb volume over North America. The mean vertical transport, supported by the vertical eddy transport, is combined to move the ozone primarily downward through the stratosphere. At the tropopause the vertical eddies transport the ozone to the troposphere for eventual destruction. Author (TAB)

N70-37772# Texas Univ., Austin. Electronics Research Center.
AN INVESTIGATION OF THE MAGNETOTELLURIC TENSOR IMPEDANCE METHOD
Darrell R. Word, H. W. Smith, and F. X. Bostick, Jr. 15 Mar. 1970 281 p refs
(Contract N00014-67-A-0126-0004; Grant NSF GA-1236)
(AD-706359; TR-82) Avail: CFSTI CSCL 8/14

A study was made of the magnetotelluric sounding method involving a tensor impedance relationship between the surface electric and magnetic micropulsation fields of the earth. A theoretical treatment of the tensor impedance (including the vertical magnetic field relationship) is offered with emphasis on its response to three-dimensional geometry. Some approximate mathematical models are proposed for use in interpreting three-dimensionality in the surface impedance. An experimental investigation conducted in central Texas is fully discussed. Author (TAB)

N70-37851# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES OF LARGE SCALE ATMOSPHERIC ENERGETICS
Final Report
L. H. Horn and D. R. Johnson Jun. 1969 118 p refs
(Grant ESSA-WBG-52)
Avail: Issuing Activity

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1. THE GENERATION OF AVAILABLE POTENTIAL ENERGY IN A MID-LATITUDE CYCLONE D. G. Hahn and L. H. Horn p 1 56 refs (See N70-37852 21-13)

2. A STUDY OF THE INDIAN MONSOON USING STATELLITE MEASURED ALBEDO AND LONG WAVE RADIATION G. J. Dittberner and F. Sechrist p 57 92 refs (See N70-37853 21-13)

3. KINETIC ENERGY CHANGES IN A DEVELOPING CYCLONE F. Sechrist and R. A. Rudy p 93 114 refs (See N70-37854 21-31)

N70-37852# Wisconsin Univ., Madison. Dept. of Meteorology.
THE GENERATION OF AVAILABLE POTENTIAL ENERGY IN A MID-LATITUDE CYCLONE
Douglas G. Hahn and Lyle H. Horn *In its* Studies of Large Scale Atmospheric Energetics Jun. 1970 p 1 56 refs (See N70-37851 21-13)
Avail: Issuing Activity

The generation expression in the energy equations is modified so that it represents the available potential energy generated at the synoptic scale. The generation based on a regional reference state and heating estimates is studied both temporally and spacially in case studies of two March 1962 mid-latitude cyclones. Author

N70-37853# Wisconsin Univ., Madison. Dept. of Meteorology.
A STUDY OF THE INDIAN MONSOON USING SATELLITE MEASURED ALBEDO AND LONG WAVE RADIATION
Gerald J. Dittberner and Frank Sechrist *In its* Studies of Large Scale Atmospheric Energetics Jun. 1969 p 57 92 refs (See N70-37851 21-13)
Avail: Issuing Activity

Thirty months of continuous low resolution satellite data, emitted long wave radiation and albedo are used to study the Indian monsoon. These data, combined with rainfall data for the Indian subcontinent, are employed to develop an intensity index which provides the first quantitative measure of monsoon intensity. Three monsoons are studied: the 1963 monsoon, the strong 1964 monsoon, and the very weak 1965 monsoon. Intensity differences show up most dramatically on the intensity index maps. The time history of the 1964 and 1965 monsoons are examined showing how the intense cloudiness of the 1964 monsoon lingered on for a number of months apparently reducing surface heating significantly preceding the weak 1965 monsoon. Typical values of the intensity index, long wave radiation, and albedo are compiled for each season of the year preceding the 1964 and 1965 monsoon. Author

N70-37854# Wisconsin Univ., Madison. Dept. of Meteorology.
KINETIC ENERGY CHANGES IN A DEVELOPING CYCLONE
Frank Sechrist and Richard A. Rudy *In its* Studies of Large Scale Atmospheric Energetics Jun. 1969 p 93 114 refs (See N70-37851 21-13)
Avail: Issuing Activity

An analysis of a major cyclone occurring over the United States in late April, 1968, was accomplished. An attempt was made to measure both the contributions of kinetic energy advection and the changes of total kinetic energy within a fixed volume containing the storm. Results of the study showed that even though net kinetic energy dissipation intially occurred, the storm developed primarily because of the large contributions of kinetic energy advection; energy conversion was taking place but could not compensate for the layer dissipation process. Author

N70-37870# Stanford Research Inst., Menlo Park, Calif.
RADAR INVESTIGATIONS OF AURORAL INFRASONIC WAVE SOURCES Annual Report, 26 Feb. 1969 - 25 Apr. 1970
Edward J. Fremouw Apr. 1970 76 p refs
(Contract F44620-69-C-0074)
(AD-706904; AFOSR-70-1431TR) Avail: CFSTI CSCL 4/1

A radar investigation of possible sources of auroral infrasonic waves (AIW) has disclosed evidence of a relation between AIW sources and radar aurora in supersonic motion. The study employed pre-existing and specially obtained data from the DASA-SRI auroral radar located near Homer, Alaska. Data from the Homer radar were compared with AIW data obtained during five equinoctial periods at the infrasonics observatory operated by the Geophysical Institute of the University of Alaska at College, Alaska. Author (TAB)

N70-37883# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 232 15 Jul. 1970 p 32 - 42 refs (See N70-37880 21-30)
Avail: CFSTI

Publications on the results of the Soviet-Cuban marine expedition in the Caribbean, ferromanganese nodule studies, sealab construction, scientific research submarine capabilities, scientific research ship studies, North Atlantic research, and an automatized marine gravimeter description are reported. Studies in the following fields are abstracted: the number and production of bacteria in the Pacific Ocean, the correlation between surface water temperature and hurricane force, density stratification in the ocean, invesigations using underwater carriers, and the properties of secondary turbulence. P.A.B.

N70-37884# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 232 15 Jul. 1970 refs p 43 - 50 refs (See N70-37880 21-30)
Avail: CFSTI

A conference of socialist countries on planetary geophysical research, terrestrial magnetism research, electromagnetic field examinations in inhomogeneous media, an earthquake in Kirgiziya, and a newly modified quartz magnetic variometer are reported. Abstracts are presented for work on the variations in the appearance of Pcl pulsations in the middle latitudes; correlations between neotectonics, crustal movements, and the Mohorovicic discontinuity; the use of a computer in plotting seismic activity maps; deep magnetotelluric sounding on the Siberian platform; magnetic field determinations of the deep distribution of conductivity in the earth, the geomagnetic field of the Black Sea depression, and gravimetric determinations in Antarctica. P.A.B.

N70-37885# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 232 15 Jul. 1970 p 51 - 122 refs (See N70-37880 21-30)
Avail: CFSTI

The launchings of Cosmos 346, 347, 348, and 349 are reported. Progress reports on Soyuz 9, from its launching to flight completion, are presented, including spaceflight control center observations, ground conversations with the spacecraft, orientation information, experimental purposes, and comments on weightlessness. The contribution of space science to a knowledge of the earth is discussed, and the problems involved in space tracking are described. Articles on a universal expeditionary telesclope, an automatic cosmic ray station, a neutron supermonitor, and the output recorder of a cosmic ray station are also reported. Scientific research abstracts include: the nonlinear effects of ionospheric radio wave propagation, the colorimetry of the twilight sky, proof of the existence of hydrogen ion flux in the exoshpere, air density distribution in the stratosphere, cosmic ray semidiurnal variations, aurora distribution, F1 layer behavior, optimum trajectories for interplanetary space probes, and the conditions for aircraft landing during low stratiform clouds. P.A.B.

N70-37890# Army Engineer Topographic Labs., Fort Belvoir, Va.
MENSURATION AND REDUCTION ACCURACY AND PRECISION STANDARDS APPLICABLE TO AN INTEGRATED, WORLDWIDE, TOPOGRAPHIC SYSTEM
Nathan Fishel Mar. 1970 16 p refs
(AD-707430; USAETL-58-TR) Avail: CFSTI CSCL 8/2

The report relates errors of observing, measuring, recording, and computing and weaknesses in mathematical expression structures to the data acquisition, mensuration, and information processing phases of a proposed Army, integrated, worldwide, topographic system (IWTS). Mensuration and reduction standards are given to clarify, to consolidate, to make concise, and to free from ambiguity the statistic, analytic, and algebraic nomenclatures and expressions for IWTS. The conventional methods of the least squares and the statistical methods using probability/density distributions are combined. The standards in measurement of errors and analyses are foundations upon which the performance-prediction models can be assembled to provide answers to user requirements. Author (TAB)

N70-37977# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BRL DEWPOINT HYGROMETER BALLOON FLIGHTS, 1958 - 1966
Emmett J. Pybus Mar. 1970 299 p refs
(AD-706217; BRL-1480) Avail: CFSTI CSCL 4/1

Presented here are brief descriptions of the field activities which were part of the BRLs atmospheric water vapor measurement program from 1958 through 1966. The flights are put into ten categories, called Flight Series, which roughly correspond to instrument improvements as well as to flight purpose. Final data for each flight are presented, where there were data, and also data comparisons are made in four cases. Data profiles are given in two forms, temperature versus altitude and mixing ratio versus altitude. Author (TAB)

N70-38004# Naval Postgraduate School, Monterey, Calif.
VARIATION IN THERMAL STRUCTURE AND GEOSTROPHIC CURRENT BETWEEN ALASKA AND HAWAII DETERMINED FROM SYNOPTIC SPACE SECTIONS
George Keith Gowans (M.S. Thesis) Oct. 1969 73 p refs
(AD-706077) Avail: CFSTI CSCL 8/10

Five synoptic space sections along 158W longitude between Hawaii and the Aleutian Islands were developed from data collected by airborne expendable bathythermographs during experiment PARKA, a research project sponsored by the U. S. Navy in 1968. The sections are examined for spacial and temporal variation in thermal structure and geostrophic surface velocity. Two recently developed analysis techniques are employed. Denners T-S gradient method, wherein thermal and haline contributions to total geostrophic velocity are distinguishable, expedites calculations and results in velocity fields comparable to those developed by the dynamic method. Thermocline parameters are developed using Bostons objective definition of the thermocline, a statistical curve-fitting technique which develops the notion of a Gaussain thermocline. Gross features of thermal structure remain fairly consistent during the heating season; however, thermal fronts are observed to vary in time and space. The distribution of isothermal lines with latitude suggests the possibility of a Taylor-column effect slightly north of Hawaii. Author (TAB)

N70-38035# Naval Postgraduate School, Monterey, Calif.
SIMPLIFIED NUMERICAL MODELS FOR THE GENERATION OF SYNTHETIC REFLECTION PROFILING SEISMOGRAMS AND SYNTHETIC REFLECTION/REFRACTION SEISMOGRAMS
Charles David Lodge (M.S. Thesis) Apr. 1970 128 p refs
(AD-706733) Avail: CFSTI CSCL 8/11

Two numerical models were developed which generate synthetic seismograms in formats similar to those of records obtained in field exploration. The models solve the hyperbolic wave equations in one and two dimensions by finite difference approximations in initially undeformed solution domains of transversely-isotropic layered media subjected to a time varying, dilatational forcing stress applied at the surface. A velocity attenuation term was included in the models to inhibit strong boundary reflections. The one-dimensional model produces synthetic reflection profiling seismograms for arbitrary horizontal or dipping layers. The two-dimensional model generates synthetic reflection/refraction seismograms for horizontal layered media with arbitrary distribution of wave velocities, Poissons ratio and density. Several sample records were produced for some representative velocity structures. The synthetic seismograms were interpreted and gross correlation was carried out as if they were actual field records. Author (TAB)

N70-38038# Naval Postgraduate School, Monterey, Calif.
HURRICANE HEAT POTENTIAL OF THE GULF OF MEXICO
Douglas Volgenau (M.S. Thesis) Apr. 1970 61 p refs
(AD-706714) Avail: CFSTI CSCL 8/10

An analysis of the hurricane heat potential of the Gulf of Mexico early in the hurricane seasons for the individual years 1965 to 1968 was conducted. Results show that if the heat content of water at 26C is taken as zero, then the amount of heat available per sq cm in the Gulf varies from approximately 700 to 31,600 calories. The areas of high heat content are found to vary yearly. Further, since the sea surface temperature decrease during a storm depends upon the near surface vertical temperature gradient, the temperature differences between the surface and 30m depth were also studied. Vertical temperature differences were found to vary from 0C to 11.6C, depending upon location. Computations based on ranges of heat content and vertical temperature structure showed that a passing hurricane with an assumed flux from the sea of 4,000 cal/sq cm/day would cause the sea surface temperature to decrease some 3.1C per day in some regions but only 0.8C in others. Author (TAB)

N70-38089# California Univ., San Diego. Marine Physical Lab.
ORB-RUM OPERATIONS, 27 - 30 JANUARY 1970. REPORT 1: SEA FLOOR TECHNOLOGY
Victor C. Anderson and Daniel K. Gibson 1 Apr. 1970 28 p
(Contract N00014-69-A-0200-6002)
(AD-707342; SIO-Ref-70-13) Avail: CFSTI CSCL 8/10

Sea floor operations with RUM and ORB carried out in January 1970 are described. Transponder navigation, Remote Manipulation, Sonar Market tests, and traverse in soft silt and on firm sand are areas of interest in which experience was obtained. Author (TAB)

N70-38128# Toronto Univ. (Ontario). Inst. for Aerospace Research.
ROCKET RESEARCH
In its [Inst. for Aerospace Res.] Nov. 1969 p 80-86 (See N70-38116 21-01)
Avail: CFSTI

An improved version of the electron-beam optical instrument is now completed for a rocket flight in the near future. In addition, on this flight of AEF II-121, developmental working models will be carried of two new instruments. The first is a highly developed and much smaller and lighter version of the basic electron beam instrument. It will be a three-channel apparatus measuring the particle densities of molecular oxygen and nitrogen, as well as that of atomic oxygen. The cross section data required for the interpretation of the experiment have been measured in the laboratory for the molecular gases. A special apparatus for the measurement of the cross section in atomic oxygen is now under construction. The second instrument determines kinetic temperature, and composition in the altitude range where collisionless flow conditions prevail. It makes use of the differential spreading due to thermal motion of a slab-like of a simple ionization range. It will overlap and complement the altitude range of the electron-beam optical instruments. Author

N70-38157 California Univ., Berkeley.
HORIZONTAL TRANSVERSE MOTION FROM EARTHQUAKES AT NEAR DISTANCES
John Roy Filson (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-18918

An observational and theoretical study has been made of the horizontal transverse (SH) motion from earthquakes at near distances in central California. The direct SH arrival could be easily identified from sources within 100 km; the apparent surface velocities measured at two stations are 3.60 + or - .05 km/sec and 3.51 + or - .06 km/sec. In most cases the horizontal component of source motion, deduced from particle motion diagrams of the direct S motion at a single station, shows alignment with the strike of the regional faulting. The observed initial long period motion, Sn, is due to diffraction at the crust-mantle boundary while the slower, large amplitude arrivals are caused by multiple reflections within the crust. Suites of theoretical seismograms were computed to test the effect of variation of certain model parameters. In general, decreasing the epicentral distance or half space velocity, or increasing the layer velocity or layer thickness, increases the amplitude of the diffracted Sn motion. Dissert. Abstr.

N70-38162# United States Lake Survey, Detroit, Mich.
COLOR-VELOCITY METHOD IN MEASURING DISCHARGE
Ira M. Korkigian and Thomas E. Ottenbaker Jun. 1969 24 p refs
(AD-706874; MP-70-1) Avail: CFSTI CSCL 8/8

This is the first attempt by the U. S. Lake Survey in applying fluorescent dyes for measurement of the discharge in an open channel. The purposes of the tests were: (1) to become familiar with the instrumentation and the use of fluorescent dyes, and (2) to compare the results of the dye method with standard current meter methods. Five tests were run, with three being run simultaneously with standard methods. Author (TAB)

N70-38171# Princeton Univ., N.J. Information Sciences and Systems Lab.
COMPRESSION OF TOPOGRAPHICAL DATA AND APPLICATIONS
Theodosios Pavlidis Mar. 1970 62 p refs
(Contract DAHC04-69-C-0035)
(AD-706222; AROD-8244-3-A; TR-31) Avail: CFSTI CSCL 8/2

The report describes the application of a segmentation technique for achieving compression of topographical data. A series of Monte Carlo tests is used to evaluate the quality and cost of the resulting approximation. It shows that in most instances the error due to the approximation is only a small fraction of the maximum. Therefore a large maximum error may be tolerated in the original design and thus a greater data compression may be achieved. Author (TAB)

N70-38189# Geological Survey, Washington, D.C.
GEOLOGIC TIME: THE AGE OF THE EARTH
William L. Newman 1970 20 p
Avail: Issuing Activity

A relative time scale on rock stratification and an atomic time scale for measuring radioactivity of rocks, which are utilized to determine approximately the age of the earth, are described. Tables include data on major divisions of geologic time with examples of index fossils, correlation of rock units within a small area, a composite geologic reaction of formations in southwestern United States, parent isotopes and daughter products used to determine ages of ancient rocks, and rocks and materials that have been dated by atomic clock methods. A graphic illustration of the geologic time scale is also given showing both relative time and atomic time.
E.H.W.

N70-38203# Ohio State Univ., Columbus. Dept. of Geodetic Science.
LEAST-SQUARES ESTIMATION IN PHYSICAL GEODESY
Helmut Moritz Mar. 1970 59 p refs
(Contract F19628-69-C-0127)
(AD-707508; DGS-130; AFCRL-70-0202; SR-4) Avail: CFSTI CSCL 8/5

A powerful and simple least-squares estimation method for the gravitational field, due to T. Krarup, is presented and applied to such different problems in physical geodesy as the geodetic boundary-value problem according to A. Bjerhammar, the application of aerial gravimetry, the geodetic use of gradiometer measurements, and the combination of gravimetry with satellite harmonics and with astrogeodetic data. The algorithm is formally identical to that of usual least-squares gravity estimation; it is only necessary to interpret the covariances in a different way. The data may be errorless or affected by observational errors.
Author (TAB)

N70-38216# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 234 7 Aug. 1970 p 11-20 refs (See N70-38213 21-30)
Avail: CFSTI

News briefs and abstracts of articles are reported on French-Soviet cooperation in the study of interaction between the atmosphere and ocean, cruises of Soviet research ships, the age and origin of the oceans, deep probing of the ocean, the need for regulating fish resources, the mineral composition of sediments in the Romanche Trench, the thermal structure in Pacific equatorial currents, increasing density with mixing of four water masses, the crustal structure and sediments in the Central Arabian Basin, seismic studies in the Greenland Sea, the distribution of suspended matter in the Atlantic Ocean, and brightness distribution in turbid media.
R.B.

N70-38217# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 234 7 Aug. 1970 p 21-28 refs (See N70-38213 21-30)
Avail: CFSTI

News briefs and abstracts of articles are reported on a book on seismic zoning in the USSR, the study of deep crustal faults by deep seismic sounding, estimating the extent of an earthquake focus, the fine structure of Pci micropulsations, the structure and development of the earth's crust in the Ukraine, the deep structure of the southern slope of the Turan Platform, aerogravimetric measurements over the Caspian Sea, improving the parameters of seismometer pendulum systems, and universal reduction of gravity for small-scale surveys.
R.B.

N70-38218# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space No. 234 7 Aug. 1970 p 29-39 refs (See N70-38213 21-30)
Avail: CFSTI

News briefs and abstracts of articles are reported as maneuvering spacecraft in orbit, plans for rocket launchings in the Pacific Ocean, criticism of U. S. space research, the orbital correction maneuver by the Soyuz 9 spacecraft the distribution of plasma drift in the F2 region, NO(+) and O2(+) ions in the lower ionosphere, the density of charge sources in atmospheric interactions, atmospheric parameters at altitudes of 80 to 120 km, investigation of ionospheric drift, methods for studying two rays reflected from meteor trails, the use of the similar models for studying the dynamic properties of space vehicles, the structure of the high altitude magnetosphere, and trajectories for close flight around the moon.
R.B.

N70-38224# Kansas Univ., Lawrence. Dept. of Geography.
THE ROLE OF LANDSLIDES IN SLOPE DEVELOPMENT IN THE HIGH RAINFALL TROPICS Final Report
David S. Simonett Mar. 1970 27 p refs
(Contract Nonr-583(11))
(AD-706102) Avail: CFSTI CSCL 8/13

In this study are briefly reviewed the aims of a research project on the role of landslide development in the high rainfall tropics. The degree to which these aims are realized is discussed as are the type and character of other problems requiring investigation. The following conclusions were reached, in these studies in the Australian Trust Territory of New Guinea, as reported in earlier technical reports: (1) There are statistically significant relations between landslide size and frequency, and rock and vegetation type; (2) Types of landslides vary markedly from lithology to lithology; (3) There are critical minimum angles for the initiation of each landslide type; (4) Denudation by landsliding is of the order of 1 foot every 400 years in New Guinea, except in areas where spectacular earthquakes occur, where rates as great as 1 foot in 233 years may be noted; (5) Aerial photographs may be used to estimate landslide denudation with considerable accuracy; (6) There was a high degree of internal consistency between methods of measuring the rate at which new landsliding takes place. These included discussions with New Guinean Highland peoples; using aerial photographs of different ages to count new landslides per unit time; estimating with air photographs and field work, rates of revegetation or landslides.
Author (TAB)

N70-38233# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC EFFECTS OF EARTHQUAKES AND EXPLOSIONS [SEYMICHESKIYE KOLEBANIYA PRI ZEMLETRASENIYAKH I VZRYVAKH]
F. F. Aptikayev Jul. 1970 162 p refs Transl. into ENGLISH of the book "Seymicheskiye Kolebaniya Pri Zemletraseniyakh i Vzryvakh" Moscow, Izd. AN SSSR, 1969
Avail: CFSTI

The main objective of this work is to establish the most common laws governing the dynamics of seismic waves near a source. Here the amplitudes, apparent periods, and duration of vibrations are studied as a function of the physical and mechanical properties of the medium, source energy, and hypocentral distance. The rules determined permit conversion of relative energy scales to an absolute scale. This information will also be useful to work in explosives.
Author

N70-38281# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
RESEARCH IN SEISMOLOGY Annual Report, 1 Nov. 1968 - 31 Oct. 1969

Frank Press, M. Nafi Toksoz, and K. Aki 8 Apr. 1970 476 p refs
(Contract AF 49(638)-1632; ARPA Order 292-66)
(AD-706872; AFOSR-70-1004TR) Avail: CFSTI CSCL 8/11

Seismic research projects supported by the contract are summarized under three broad categories. The structure and some properties of the earths mantle and deep interior are investigated using arrays and dt/d(delta) measurements, dense net of stations in North America, as well as seismic surface waves and free oscillations. Body and surface wave propagation in media with irregular interfaces is studied using numerical techniques. Magnitude discrepancies, focal depths, mechanisms and statistics of earthquake occurrences are discussed. Author (TAB)

N70-38320*# Techtran Corp., Glen Burnie, Md.
GEOLOGICAL SHIFTS AT THE DIVIDING LINE BETWEEN THE MIDDLE AND UPPER DEVONIAN FORMATIONS IN THE CZECH MASSIF [O POHYBECH NA ROZHRANI STREDNIHO A SVRCHNIHO DEVONU V CESKEM MASIVU]
Karl-Armin Troeger et al. Washington NASA Sep. 1970 4 p refs Transl. into ENGLISH from Casopis Mineral. Geol. (Prague), v. 7, no. 2, 1962 p 165-166 Submitted for publication
(Contract NASw-2037)
(NASA-TT-F-13146) Avail: CFSTI CSCL 08G

Major epeirogenetic as well as orogenetic shifts at the dividing line between the Middle and Upper Devonian formations are reviewed, including the nature of these movements in the Czech Massif. In Saxony-Thuringia, discordant deposits of the Upper-Devonian layers on older foundations are noted. It has been that, prior to the Upper-Devonian transgression, the pre-Upper-Devonian layers were wrinkled or at least raised at the dividing line between the Middle and Upper Devonian layers; these shifts are called the Reuss phase. Heavier shifts found at the dividing line between the Middle and Upper Devonian systems are referred to as Early Breton phase. Author

N70-38364# Geological Survey, Washington, D.C.
ANCIENT LAVAS IN SHENANDOAH NATIONAL PARK NEAR LURAY, VIRGINIA
John C. Reed, Jr. 1969 50 p refs *Its* Geol. Surv. Bull. 1265
Avail: SOD

In the Blue Ridge Province of northern Virginia Maryland, and southern Pennsylvania, Lower Cambrian beds are underlain by a thick sequency of greenstone and interbedded sedimentary rocks known as the Catoctin Formation. An area near Luray, Va. was studied to determine the thickness of the formation, its relationship to overlying and underlying rocks, and the original nature of the lavas from which the Catoctin greenstone was derived. There the Catoctin Formation lies unconformably on granitic rocks. Its basal sedimentary layer ranges from a few inches to 150 feet in thickness and contains pebbles of underlying basement rocks. The erosion surface beneath the Catocin is irregular, and in several places, hills as much as 1,000 feet high were buried beneath the Catoctin lavas. No important time break is indicated between the deposition of the Catoctin Formation and the overlying Cambrian sediments. The original Catoctin lavas were basaltic and were probably normal plateau basalts. Columnar joints, amygdules, sedimentary dikes, flow breccias, low-dipping primary joints, and other primary structures are well preserved. Author

N70-38392# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
A BALLOON MEASUREMENT OF OZONE NEAR SUNRISE
Jagir S. Randhawa Apr. 1970 28 p refs
(AD-707418; ECOM-5300) Avail: CFSTI CSCL 4/1

The rocket-borne ozonesonde developed at the Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico, was modified to include a constant-volume sampling pump in place of the reservoir. Two such instruments along with other sensors were launched on a 30.3 million cubic foot balloon on 23 September, 1969 from White Sands Missile Range. The data were continuously obtained as the balloon ascended through the stratosphere and floated near 46 km at the time of sunrise. The marked decrease in the ozone concentration at sunrise occurred very rapidly, and there was almost no effect of the scattered radiation at this altitude during the pre-sunrise time. Author (TAB)

N70-38395# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INCOHERENT SCATTER MEASUREMENTS OF F-REGION DENSITY, TEMPERATURES AND VERTICAL VELOCITY AT MILLSTONE HILL
John V. Evans, Ralph F. Julian, and Wallace A. Reid 6 Feb. 1970 42 p refs
(Contract AF 19(628)-5167)
(AD-706863; TR-477; ESD-TR-70-9823) Avail: CFSTI CSCL 4/1

The Millstone Hill Thomson (incoherent) scatter radar system has been operated routinely since 1963 to perform a synoptic study of F-region electron densities, and electron and ion temperatures. This report describes system changes made in 1968 which considerably increased the accuracy of the measurements and allowed their extension to higher altitudes. These changes have also made it possible to measure the vertical velocity of the plasma over the altitude range 450 to 900 km to an accuracy on the order of 5 to 10 m/sec, depending upon altitude and time of day. Of even greater significance, complete machine reduction of the results is now possible so that considerable savings in time and effort have been secured in analyzing the data. The new system permits all the radar data to be gathered in the digital computer in real time, therby eliminating the need for post real-time processing of magnetic-tape recordings of the signals. Furthermore, it is now possible to transmit the data to other workers in computer-usable form. This report describes the main functions of the computer program required to analyze the measurements, and lists the times of all measurements made with the new system prior to 1 January 1970. Examples of these results are presented and discussed. Author (TAB)

N70-38437# Weidlinger (Paul) Consultants, New York.
INVESTIGATION OF GROUND SHOCK EFFECTS IN NONLINEAR HYSTERETIC MEDIA. REPORT 4: EFFECT OF A STEP LOAD MOVING WITH CONSTANT SUPERSEISMIC VELOCITY ON A HALF-SPACE OF A VARIABLE MODULUS MATERIAL
Alva T. Matthews, Ivan S. Sandler, Hans H. Bleich Mar. 1970 56 p refs
(Contract DACA39-67-C-0048)
(AD-706830; AEWES-CR-S-68-1-4) Avail: CFSTI CSCL 8/13

The report considers the two dimensional effects of a step wave progressing with constant superseismic velocity on the surface of a half-space. The material treated is isotropic and it is assumed that incremental relations between both deviatoric and volumetric stress and strain depend not only on the instantaneous values of those quantities, but also on bulk and shear moduli which differ according to whether initial loading, unloading, or reloading occurs. Simple closed form solutions are obtained when the moduli K and G are constant and lie within certain limits. For the more general case, when K and G are functions of the first and second invariants of stress, solutions requiring only quadratures are found. As an auxiliary study, a problem involving a half-space of fluid with a bilinear pressure volume relation is solved. Author (TAB)

N70-38506# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics and Theoretical Physics.
PHYSICS OF THE UPPER ATMOSPHERE Final Scientific

Report, 1 Aug. 1964 - 31 Jul. 1969
David R. Bates 30 Sep. 1969 18 p refs
(Contract AF 61(052)-780)
(AD-706130; AFCRL-70-0204) Avail: CFSTI CSCL 4/1

Quantal investigations have been carried out on the following: the average excitation energy of an atom or molecule appropriate to the slowing down of a beam of charged particles in a gas; the long-range interactions between pairs of atoms and also between three hydrogen atoms; various atomic structural problems including the polarization of a closed shell core by an outer electron, relativistic corrections to the eigenenergies for the helium sequence, correlation energies of the lithium sequence, isotope shifts in Li and B(2+). Theoretical studies have been made of the following upper atmospheric problems: the source, abundance and distribution of each of hydrogen, metastable helium and nitrous oxide; the electron temperature in the D-region; the diurnal variation of the temperature and density (assuming solar ultra-violet heating); the Doppler profiles of the 5577 A airglow. Author (TAB)

N70-38529# National Environmental Satellite Center, Washington, D.C.
REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY: ANNOTATED BIBLIOGRAPHY
D. R. Baker, A. F. Flanders, and M. Fleming Jun. 1970 30 p refs
(ESSA-TM-NESCTM-10) Avail: CFSTI

Presented is an annotated bibliography for a satellite hydrology program. The objective of this program is to develop hydrologic problems from satellite investigations, reports, and studies. G.G.

N70-38564# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MILLSTONE HILL THOMSON SCATTER RESULTS FOR 1965
John V. Evans 8 Dec. 1969 56 p refs
(Contract AF 19(628)-5167)
(AD-707501; ESD-TR-69-387; TR-474) Avail: CFSTI CSCL 4/1

The report presents F-region electron densities, and electron and ion temperatures observed during the year 1965 at the Millstone Hill Radar Observatory by the UHF Thomson (incoherent) scatter radar. The measurements were made over 48-hour periods that were usually scheduled to include the International Geophysical World days near the center of each month. Geomagnetic storm sudden commencements occurred during two of the observing periods, but do not appear to have given arise to marked variation of the densities or temperatures. On the other hand, measurements made during the progress of a major storm (15-19 June 1965) exhibit large changes compared with the behavior observed in the following month. The remaining months were magnetically quiet and the density and temperature behavior were similar to those observed in 1964. Millstone is a midlatitude station exhibiting a characteristic winter and summer daytime density variation. The transition between these two types occurs rapidly around equinox, without any corresponding seasonal change in the F-region thermal structure. Current ideas concerning the mechanisms responsible for this and other features of diurnal and seasonal variations are discussed. Author (TAB)

N70-38566# Environmental Science Services Administration, Rockville, Md.
ESSA SCIENCE AND ENGINEERING, 1 JULY 1967 - 30 JUNE 1969
1970 137 p refs
Avail: CFSTI

Organization goals are discussed as well as information on the reorganization and program structure through which the agency has solved key problems involving measurement, description, and prediction of physical environment conditions. The goals include protection of life and property from environmental hazards, promoting economic development, contributing to the maintenance of the physical environmental quality, and contributing to the use and enjoyment of the physical environment by individual consumers. Also discussed are agency work in weather forecasting, and warnings, earth and marine description-mapping and charting, telecommunications and space services, environmental satellite services, environmental data, and space science. E.H.W.

N70-38607# Saclant ASW Research Center, La Spezia (Italy).
A STUDY OF INTERNAL WAVES IN THE STRAIT OF GIBRALTAR DURING OCTOBER - NOVEMBER 1967
J. Ziegenbein 15 Nov. 1968 56 p refs
(Saclantcen-TR-127) Avail: CFSTI

Short internal waves of high amplitude in the Strait of Gibraltar are described. Moored temperature sensor arrays monitored the temperature structure of the upper 250 m of the water. The internal wave trains had average oscillation periods of 13 minutes and average amplitudes of 26 m. The maximum deflection centre of the isotherms was at a depth of about 63 m, being linked to the 15.4 C isotherm. The arrival of the internal fronts off Gibraltar coincided roughly with the time of low water at Gibraltar. It is assumed that these internal waves occur during the transition from a stable to an unstable stratification of the water and their wavelength can be calculated with a two-layer model. Author (ESRO)

N70-38608# Saclant ASW Research Center, La Spezia (Italy).
THE REFLECTIVITY OF THE TOP LAYER IN THE NAPLES AND AJACCIO ABYSSAL PLAINS
O. F. Hastrup 15 Jul. 1968 46 p refs
(Saclantcen-TR-118) Avail: CFSTI

The influence of the acoustic reflectivity from the top layer of the ocean floor in the Naples and Ajaccio abyssal plains of the Mediterranean was investigated. The reflection losses were measured for angles of incidence from 0 deg to 83 deg using peak amplitudes. Acoustic parameters obtained from a large number of cores from these areas were used to compute theoretical loss curves which agreed with the measured ones. Author (ESRO)

N70-38613# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Aug. 1970 35 p refs
Avail: CFSTI

Research progress is reported on magnetoglow, thermal defocusing of a laser beam in air, communications techniques, applied and pure mathematics, physical metallurgy, ocean technology, crystal structures, high-temperature plasma physics, and radar analysis of whitecaps on water waves. Information is also reported on patents issued during the period. R.B.

N70-38660# Auroral Observatory, Tromso (Norway).
ELECTRON CONTENT AND SMALL SCALE IRREGULARITIES IN THE POLAR IONOSPHERE Final Scientific Report, 1 Nov. 1966 - 31 Oct. 1969
Ove M. Bratteng and Jon Frihagen 20 Dec. 1969 65 p refs
(Contract F61052-67-C-0020)
(AD-707139; AFCRL-70-0286) Avail: CFSTI CSCL 4/1

Some results of high latitude measurements of electron content and scintillation by means of satellite beacons are presented and discussed. Studies previously reported have been extended and amplified. Some features of the diurnal variation of the polar cap electron content can be explained by quite reasonable models. The polar enhancement of electron content mapped in geomagnetic

coincides with a corresponding maximum in VLF-noise. The electron content dependency on the mean sunspot activity has a marked semi-annual variation with a maximum at the equinoxes. Pc5 micropulsations seem to enhance the morning growth of the F-layer. Geomagnetic storms very often induce large variation in electron content. There is a trend for a positive phase during the first hours after sudden commencement followed by a rather large negative phase exhibiting a maximum after about 24 hours. The high latitude F-region irregularities are separated in the auroral and polar maxima. There is a very strong Kp dependence even for the lowest Kp-indices. Author (TAB)

N70-38670# Saclant ASW Research Center, La Spezia (Italy).
ACOUSTIC AND OTHER PHYSICAL PROPERTIES OF DEEP SEA SEDIMENTS IN THE TYRRHENIAN ABYSSAL PLAIN
A. Kermabon, C. Gehin, P. Blavier, and B. Tonarelli 30 Apr. 1968 57 p refs
(Saclantcen-TR-113) Avail: CFSTI

Twenty-one cores taken in the Tyrrhenian abyssal plain (40 n.mi west of Naples) were analyzed for acoustic and mass physical properties. Bottom topography and sub-bottom structure were measured in the same area by means of echo-sounding. The microtectonics of the bottom layers demonstrated by the core analysis is not visible in the echograms due to the integrating process of echo-sounders with large beam widths, thus demonstrating that echograms give only the general features of a geologically complicated area. Author (ESRO)

N70-38673 National Lending Library for Science and Technology, Boston Spa (England).
A CONTRIBUTION TO THE STUDY OF THE BIENNIAL OSCILLATION IN THE ATMOSPHERIC CIRCULATION IN THE EARTH'S NORTHERN HEMISPHERE
B. A. Siepcov-Sevlevic 24 Jun. 1970 12 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 29, 1968 p 36 - 44
(NLL-M-9222-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Daily data on the frequency of the westerly form of atmospheric circulation for the period 1891 to 1964 were used for the study. The atmospheric circulation indices were subjected to a harmonic analysis with a period of 12 months. The amplitudes and phases of seasonal variations of zonal circulation were obtained from the harmonic analysis of the annual series. The variation of the amplitudes and values of the parameters are given. It is shown that there is a correlation between the biennial oscillation and the secular cycle of solar activity. R.B.

N70-38682# University Coll., Nairobi (Kenya). Dept. of Physics.
IONOSPHERIC RESEARCH USING SATELLITES Final Scientific Report, 17 Nov. 1965 - 6 Oct. 1969
A. N. Hunter and R. F.Kelleher Nov. 1969 46 p refs
(Contract AF 61(052)-909)
(AD-707131; AFCRL-70-0289) Avail: CFSTI CSCL 4/1

Summaries are given of results obtained from total electron content measurements, scintillation observations and spaced aerial irregularity studies in East Africa. The development and movement of the equatorial anomaly in total electron content throughout the day is examined for different seasons and the effects found to be most pronounced in the equinoxes. Some control by magnetic acitivity is indicated. A number of problems in the data reduction are discussed. Variations in the extent of the F-region equatorial irregularity belt with season and local time have been found. Irregularities have been detected (by dispersion analysis) at heights from 85-800 km, the average size (20-400 m) being almost constant at all altitudes. The maximum occurrence is found at or near hmF2 and at Es heights. The movement of irregularity patches is predominantly towards the east before 0600 L.M.T., and to the west after this time. Considerable polarization scintillation is found at 20 MHz. Author (TAB)

N70-38734# Saclant ASW Research Center, La Spezia (Italy).
THE SUB-BOTTOM STRUCTURE OF THE GULF OF LA SPEZIA
L. R. Breslau and H. Edgerton 1 Dec. 1968 89 p refs
(Saclantcen-TR-129) Avail: CFSTI

The acoustic reflectivity of the sea floor was investigated by correlation of seismic discontinuities with sedimentalogic truth. The sub-bottom structure of the Gulf of La Spezia, Italy, was investigated by continuous seismic profiling and sediment coring. The seismic profiles were used to develop contour plots of sub-bottom layers, which were identified from the core measurements. Coring established that the seismic layers were related to sand and peat layers and that dome-shaped features were composed of coral. ESRO

N70-38735# Saclant ASW Research Center, La Spezia (Italy).
DEVELOPMENT OF SIMPLE EQUATIONS FOR ACCURATE AND MORE REALISTIC CALCULATION OF THE SPEED OF SOUND IN SEA WATER
C. C. Leroy 15 Nov. 1968 49 p refs
(Saclantcen-TR-128) Avail: CFSTI

Many equations for calculating the speed of sound in the sea are inaccurate but limiting the data to be fitted to those that correspond to real sea water conditions, it was found that simpler and more accurate equations can be developed. Two new equations are presented. One fits Wilson's second equation for sea water to within 0.1 m/s in the domain described, and the other fits Wilson's corresponding data with a better accuracy than Wilson's equation. Author (ESRO)

N70-38745# Environmental Research Corp., Alexandria, Va.
ONE DIMENSIONAL EARTH MOTION CALCULATIONS
C. R. Cassity, A. H. Davis, and L. D. Mc Quinn Apr. 1970 24 p refs
(Contract AT(29-2)-1163)
(NVO-1163-TM-11) Avail: CFSTI

A one-dimensional computer program which describes spherically symmetric motions following an underground nuclear explosion was developed. Plastic and brittle failure in the earth medium is taken into account. The recent improvements in the program are described, the most important of which is a subroutine which selectively rezones portions of the mesh and selects an optimum time increment. The first results of an extensive parameter study are given, covering the effects of failure criteria, depth of burial, and yield on final cavity radius, cracking radius, and stress profiles. It is recommended that the program be used as an input for a two-dimensional elastic earth motion program, as well as for predictions of close-in effects in forthcoming events. Author (NSA)

N70-38758# Houston Univ., Tex. Wave Propagation Labs.
LABORATORY SIMULATION OF OCEAN SURFACE REVERBERATION
H. S. Hayre and G. Vroulis Jul. 1969 26 p refs
(Contract Nonr-4492(02))
(AD-707099; TR-69-10) Avail: CFSTI CSCL 8/3

A summary of underwater surface reverberation and its successful laboratory simulation is given. The validity and usefulness of such a simulation and some of the problem areas associated with such simulations are discussed. Author (TAB)

N70-38776 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE THERMAL STATE OF THE POLAR REGIONS ON VORTEX ACTIVITY IN THE ATMOSPHERE
K. I. Cukanin 24 Jun. 1970 9 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 30, 1969 p 66 - 72
(NLL-M-9204-(5828.4F)) Avail: Natl. Lending Library, Boston

Spa, Engl.: 1 NLL photocopy coupon

Data are provided on the frequency of cyclonic vortices, mean densities, and horizontal air temperature gradients over the Northern Hemisphere during 1960 to 1964. Comparison of the data reveals some features of the annual variation of the number of depressions over the Northern Hemisphere and indicates how the thermal state of the planet's polar regions affects vortex activity in the atmosphere. The number of cyclonic vortices was determined from daily synoptic charts, and the mean horizontal gradients and air densities from monthly mean air temperature and pressure charts. Author

N70-38799 National Lending Library for Science and Technology, Boston Spa (England).

THE INVESTIGATION OF AGEOSTROPHIC ATMOSPHERIC MOTION

V. D. Reetov 8 Mar. 1970 127 p refs Transl. into ENGLISH from Tr. Centralnaja Aerol. Observ. (Moscow), no. 87, 1968 127 p

(NLL-M-7938-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 12 NLL photocopy coupons

Data on deviations of the wind from the geostrophic gradient are examined with respect to the phenomena of divergence of air current and cyclo and anticyclogenesis. Statistical averaging of the ageostrophic wind characteristics for typical circulation conditions in the atmosphere was used in the study. The results obtained are certain mean characteristics of the atmospheric processes with a statistical probability of about 70%. Corrections for the curvature of the isohypses were introduced into the data for the geostrophic wind so that the deviations are actually the agradient, or more commonly, the ageostrophic wind. Author

N70-38808# Saclant ASW Research Center, La Spezia (Italy).

THE RELATIONSHIP OF POROSITY WITH DENSITY, ELECTRICAL RESISTIVITY, AND SOUND VELOCITY OF SOME UNCONSOLIDATED DEEP-SEA SEDIMENTS TAKEN FROM THE TYRRHENIAN SEA

A. Kermabon, C. Gehin, and P. Blavier 30 Apr. 1968 33 p refs

(Saclantcen-TR-114) Avail: CFSTI

A study was made of the porosity, density, electrical resistivity and sound velocity of 21 cores taken from the Tyrrhenian Sea. The linear density/porosity relation was checked. A relation was found between porosity and the electrical resistivity formation factor, and a third degree polynomial curve gave the best fit. From in situ electrical resistivity measurements the electrical resistivity formation factor can be derived, and consequently the porosity and density of each type of sediment. Author (ESRO)

N70-38817# Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Sciences.

THE STRUCTURE OF SEA SURFACE TEMPERATURES IN MONSOONAL AREAS

Walter Dueing Apr. 1970 31 p refs

(Contract Nonr-4008(02))

(AD-706081; ML-70046) Avail: CFSTI CSCL 8/10

Time-dependent fluctuations of structure sizes of sea surface temperatures in the Indian Ocean and the Atlantic Ocean were determined by using three different methods of analysis: (a) graphical integration of isothermal structures, (b) computation of the structure function of temperature distributed along zonal bands across both oceans and (c) computation of energy spectra for temperatures distributed along these bands. Table 1 summarizes the main results of the investigation. Mean values of 156, 420, and 1190 km characterize structure sizes occurring most frequently in the Indian Ocean. The structure size of 420 km compares well with other independent observations: The dynamic topographies of the surface in the Arabian Sea exhibit cellular structures of similar dimensions. Satellite observations of sea surface temperatures off the Somali coast reveal isothermal structures with a diameter of approximately 450 km. Structures in the Atlantic Ocean possess mean values of 133, 370, and 1190 km, hence, do not deviate much from those in the Indian Ocean. The results for both oceanic areas not only display a high degree of similarity in structure sizes, but also indicate that large peaks in the energy spectra occur only during winter time. Author (TAB)

N70-38843*# Geological Survey, Washington, D.C.

HYDROLOGIC INTERPRETATION OF NIMBUS VIDICON IMAGE: GREAT SALT LAKE, UTAH

D. C. Hahl and A. H. Handy Nov. 1966 6 p *Its* Tech. Letter NASA-61

(NASA Order R-09-020-015)

(NASA-CR-79887) Avail: CFSTI CSCL 08E

The analysis was made to determine if features of hydrologic significance were visible and identifiable. The features that are pointed out on an annotated copy of the image indicate some of the factors that are required to produce an image. Vegetation and geology may be responsible for the delineation or lack of delineation of some features. Depth is not considered a factor in producing an image. The implications of using the Advanced Vidicon Camera System in the field of hydrology are assessed. H.S.W.

N70-38845*# Geological Survey, Washington, D.C.

COMPOSITION OF BASALT FLOWS AT PISAGH CRATER, CALIFORNIA: PRELIMINARY DATA

Jules D. Friedman Jul. 1966 41 p refs *Its* Tech. Letter NASA-20

(NASA Order R-146)

(NASA-CR-76716) Avail: CFSTI CSCL 08G

Compositional analyses are presented on the surfaces of a pahoehoe flow of eruptive phase three porphyritic olivine basalt and an aa flow of eruptive phase two porphyritic olivine basalt from Pisagh Crater, California. Single samples of the two lithologies were analyzed by several methods to determine if compositional variations between the two basalt flows are great enough, particularly at the weathered surface, to justify a program of statistical sampling and analysis. Major and minor composition of both samples were found to be similar. The older flow was slightly more sodic and the younger flow more calcalkalic, but major element composition of surface sections of both flows indicates surface enrichment in Fe_2O_3 and possibly in MnO, and depletion of FeO. Photomicrography and electron probe microanalysis show the presence of two surface layers 15 micron to 150 micron thick and also suggest surface enrichment in Fe_2O_3. The geologic implications of differences between fresh and surface materials in the samples studied could be verified by systematic sampling for compositional analysis and subsequent statistical procedures. A.G.O.

N70-38846*# Geological Survey, Washington, D.C.

USE OF INFRARED IMAGERY AND COLOR PHOTOGRAPHY IN STUDY OF MISSILE IMPACT CRATERS

H. J. Moore, David Cummings, and D. E. Gault Apr. 1967 7 p refs *Its* Tech. Letter NASA-75

(NASA Order R-09-020-015)

(NASA-CR-85481) Avail: CFSTI CSCL 08G

Daylight infrared imagery in the 8 to 13 micron band and color photography obtained from aircraft overflights 2,000 feet above the local terrain were used to study craters produced by missile impacts. Preliminary evaluation gives the following results: (1) The ejecta from the craters were detected using both infrared imaging and color photography during daylight flights. (2) The ejecta from the craters were relatively cool because of high moisture contents resulting from local rain showers, and were paler than their surroundings. Author

N70-38847*# Geological Survey, Washington, D.C.
PRELIMINARY EVALUATION OF RADAR IMAGERY OF YELLOWSTONE PARK, WYOMING
R. L. Christiansen, K. L. Pierce, H. J. Prostka, and E. T. Ruppel Jul. 1966 24 p *Its* Tech. Letter NASA-30
(NASA Order R-09)
(NASA-CR-76711) Avail: CFSTI CSCL 08G

Preliminary studies of radar imagery in the Yellowstone Park area show that it has certain valuable use in regional geological reconnaissance. Foremost among these are its all-weather capability and wide areal coverage. Geologic features are best expressed by topographic irregularities and include lineaments (faults and fractures), contrasting stream drainage patterns and glacial deposits. Flow structures in rhyolite flows enable one to distinguish rhyolite flows from ash flows and basaltic lava flows, whereas distinctive stream dissection patterns enable differentiation between lava flows and ash flows. Imprecisions and variability of scale are considered to be major disadvantages. Furthermore, there is no apparent expression of grain size, color or composition of rock types. Author

N70-38883*# Geological Survey, Washington, D.C.
INFRARED INVESTIGATIONS Status Report, 1 Jul. - 30 Sep. 1966
Robert M. Moxham Nov. 1966 13 p refs
(NASA Order R-146)
(NASA-CR-79892) Avail: CFSTI CSCL 08E

Aerial photography and radiometric data obtained during infrared surveys are presented. Techniques for aircraft navigation at night are evaluated, and fumarolic activity is reported for various areas. A study of the infrared spectral emittance of rocks is mentioned, as well as design of an apparatus for investigating possible infrared luminescence of rock-forming minerals in the vicinity of their characteristic frequencies. S.P.

N70-38884*# Geological Survey, Washington, D.C.
REFLECTANCE OF ROCKS AND MINERALS TO VISIBLE AND ULTRAVIOLET RADIATION
H. V. Watts (IIT Res. Inst., Chicago, Ill.) Jul. 1966 69 p refs *Its* Tech. Letter NASA-32
(NASA Order R-146-09-020-006)
(NASA-CR-76300) Avail: CFSTI CSCL 08E

The reflectances of 38 different samples of rocks and minerals were measured throughout the spectral range of 7000 A down to 23000 A, for both a flat ground surface and a polished surface of each material, except for the pumice and mica samples whose surfaces were measured as received. The diffuse reflectance was detected both with and without the inclusion of the specularly reflected component. None of the reflectance curves showed any characteristic peaks or bands. The shapes of the curves are generally the same for both the ground and the polished surfaces, with the total reflectance from the ground surface greater than that from the polished surface. For most samples the reflectance increases as the wavelength increases. Of major interest is the fact that the relative reflectance from sample to sample does not remain the same throughout the spectral range. Thus the contrast in imaging an array of different rocks could vary appreciably between a visible sensitive imager and an ultraviolet sensitive imager. Author

N70-38885*# Geological Survey, Washington, D.C.
PRELIMINARY STUDIES OF SOIL PATTERNS OBSERVED IN RADAR IMAGES, BISHOP AREA, CALIFORNIA
Michael F. Sheridan (Ariz. State Univ.) Nov. 1966 8 p *Its* Tech. Letter NASA-63
(NASA Order R-09-020-015)
(NASA-CR-80643) Avail: CFSTI CSCL 08G

Preliminary field studies of soil samples found within the Mt. Tom and Bishop quadrangles were made in an attempt to determine the relative moisture content and grain size of samples in the light and dark areas of radar images of the site, and to verify previously reported conclusions that the topographically lower, finer grained alluvial deposits have a darker shade than the alluvial deposits in fans and raised terraces presumably because of a higher near-surface water content. Qualitative evaluations of soil samples in nine localities showed no moisture at the surface or to a depth of six inches. It is therefore concluded that moisture did not seem to be a factor in producing the dark imagery patterns; however, there was a very good correlation of grain size with darkness. There was a strong tendency for the dark areas to be irrigated and thus to have a much heavier cover of vegetation. Where the vegetation was heavy the imagery pattern was darker than the grain size of soil produced in areas with no vegetation or little vegetation. It is further concluded that grain size is the dominant factor in determining the darkness of the color patterns in the Bishop area. S.C.W.

N70-38886*# Geological Survey, Washington, D.C.
INTERPRETATION OF ULTRAVIOLET IMAGERY OF THE METEOR CRATER, SALTON SEA AND ARIZONA SEDIMENTARY TEST SITES (MISSION 18, JANUARY 1966)
William R. Hemphill Aug. 1966 61 p refs *Its* Tech. Letter NASA-39 and NASA Suppl-39A
(NASA Order R-146-09-020-006)
(NASA-CR-77594) Avail: CFSTI CSCL 08E

A discussion is presented on the imagery obtained of the Meteor Crater, the sedimentary test site, and the Salton Sea. Image contrasts of some features appear to be enhanced in the ultraviolet as compared to the same features on conventional aerial photographs. It is believed that repeated flights over these and other test areas should improve the ability to predict ultraviolet reflectivity and image tonal density in terms of specific geologic and terrain features. The test program suggests modifications in airborne operation of the ultraviolet line scanner. It is recommended that trial flights be made with and without the AGC circuitry in operation. Details are given on each of the test flights, and additional recommendations for changes to the test program are made. Samples of conventional photographs of the test sites are provided. H.S.W.

N70-38887*# Geological Survey, Denver, Colo.
RADAR IMAGERY OF CEDAR CITY: IRON SPRINGS AREA, UTAH Preliminary Report
Paul L. Williams Sep. 1966 18 p *Its* Tech. Letter NASA-44
(NASA Order R-09-020-015)
(NASA-CR-78780) Avail: CFSTI CSCL 08E

The area studied consists of about 800 square miles and includes the Hurricane Cliffs which mark the boundary between the High Plateaus on the east and the Basin and Range province on the west. The radar images were interpreted for topography, geology, cultural, and hydrologic features, and vegetation. It was found that topographic features are well expressed by radar shadows and, that where geologic contrasts are well expressed by topography, geologic interpretation is possible. Sketch maps and radar images are presented. N.A.S.

N70-38888*# Geological Survey, Washington, D.C.
RESOLUTION STUDY
Robert H. Nugent and Hugh B. Loving 9 Mar. 1967 11 p ref *Its* Tech. Letter NASA-79
(NASA Order R-09-020-024)
(NASA-CR-84634) Avail: CFSTI CSCL 08B

The effectiveness of various photogrammetric systems was analyzed on the basis of static film resolution and height-measuring capability of stereoplotters. It is assumed that all photographic systems have geometric fidelity equal to that of a metric camera, and that ground resolution deteriorates uniformly as the flight

height increases. Procedural details are described, along with the mathematical approach which emphasizes the mean square error in measurements of parallax in the image plane. This gives reasonable correlation with the theoretical ground resolution approach. It is concluded that longer principal distance plotters offer advantages over the standard 6-inch principal distance plotters in producing larger model scales and smaller contour interval capabilities. In the lunar case, it is feasible to compile 25-meter contours from photographs taken with a 12-inch focal length metric camera, provided that a minimum resolution of 75 lines per millimeter is obtained. M.G.J.

N70-38889*# Geological Survey, Washington, D.C.
LIQUID NITROGEN BLACKBODY FOR SPECTRAL EMITTANCE STUDIES
D. L. Daniels and A. E. Stoddard Jul. 1966 16 p *Its* Tech. Letter NASA-57
(NASA Order R-146-09-020-006)
(NASA-CR-113209) Avail: CFSTI CSCL 08G

Preliminary considerations and experiments concerning the use of a black body maintained at liquid nitrogen temperature in the study of spectral emittance of rocks are reported. Provided the sample studied and a reference black body assume the same arbitrary temperature, the method gives a rather simple absolute determination of spectral emissivity utilizing the Block interferometer type spectrometer. The stated theory is that radiation incident upon the bolometer detector of the Block interferometer consists of two parts, each varying at an audio frequency proportional to the wave number of the radiation. The first part arises from radiation entering the instrument from outside, and the second part arises from radiation from the bolometer detector which is reflected back onto itself by the interferometer. S.P.

N70-38890*# Geological Survey, Washington, D.C.
GEOLOGICAL UTILIZATION OF GEMINI COLOR PHOTOGRAPH OF DUBA AREA, SAUDI ARABIA
Robert F. Johnson and Jules A. MacKallor Aug. 1966 12 p *Its* Tech. Letter NASA-43
(NASA Order R-09-020-015)
(NASA-CR-77593) Avail: CFSTI CSCL 08G

The discovery of a large wrench fault in Saudi Arabia from a Gemini 5 photograph is reported. The boundary between the Precambrian basement and the younger rocks was found to be plainly visible on the color photograph, taken at an altitude of more than 100 miles. The alignment of wadis indicates a northwest-trending structural component throughout the entire area. It is suggested that the picture illustrates the value for arid regions of photographs from space. N.E.N.

N70-38891*# Geological Survey, Washington, D.C.
APPLICATIONS OF REMOTE SENSOR DATA TO CARTOGRAPHIC PROGRAMS
W. Sibert Jul. 1966 15 p *Its* Tech. Letter NASA-51
(NASA Order R-09-020-024)
(NASA-CR-7741) Avail: CFSTI CSCL 08B

The history of natural resource surveys in the United States is briefly summarized from the western expeditions during the first half of the 19th century to the advanced satellite technology and analytical phototriangulation concepts being developed. The application of remote sensor data to topographic mapping is discussed, and several photographs indicating the potential use for map revision operations are shown. Panoramic camera applications for acquiring orbital photographs are mentioned, and the possibility of employing these cameras at heights of approximately 125 nautical miles is considered. It is stated that the use of spacecraft as remote sensor platforms offers the unique advantage of permitting cartographic data to be collected on a national and global basis within a time frame and coverage per data-bit never before convieved. Direct dollar benefits that may be realized in cartographic programs are estimated to be approximately $680 million annually by 1981. A.G.O.

N70-38892*# Geological Survey, Menlo Park, Calif.
GEOLOGIC APPRAISAL OF RADAR IMAGERY OF SOUTHWESTERN OREGON
William P. Irwin Jun. 1966 13 p *Its* Tech. Letter NASA-23
(NASA Order R-09-020-015)
(NASA-CR-76690) Avail: CFSTI CSCL 08G

Radar imagery obtained in a flight extending from near Grants Pass to the coast is evaluated. The linear scale of the radar imagery, measured parallel to the flight path, is 1 inch equals approximately 2.8 miles. The eastern part of the imagery is of the Klamath Mountains geologic province, and the western part is of the coast ranges. Author

N70-38893*# Geological Survey, Menlo Park, Calif.
GEOLOGICAL EVALUATION OF RADAR IMAGERY: SAN ANDREAS FAULT ZONE FROM STEVENS CREEK, SANTA CLARA COUNTY TO MUSSEL ROCK, SAN MATEO COUNTY, CALIFORNIA
Robert D. Brown, Jr. Aug. 1966 15 p *Its* Tech. Letter NASA-45
(NASA Order R-09-020-015)
(NASA-CR-77610) Avail: CFSTI CSCL 08G

Side-looking radar photography for geologic interpretation is discussed. A general evaluation is presented, and both polarized and depolarized imagery are described. It is pointed out that radar photography is unimpaired by cloud cover, the screening effect of vegetation is greatly reduced, and contrast is enhanced. Depolarized images were found to be particularly valuable. N.E.N.

N70-38894*# Geological Survey, Menlo Park, Calif.
GEOLOGICAL EVALUATION OF K BAND RADAR IMAGERY, NORTH-CENTRAL NEVADA
Ralph J. Roberts Aug. 1966 15 p refs *Its* Tech. Letter NASA-49
(NASA Order R-09-020-015)
(NASA-CR-77609) Avail: CFSTI CSCL 08G

Radar photography with a scale of 1:200,000 was evaluated for geological interpretation. The features of the area in Nevada are outlined. Few cultural features were recognized. Variations among specific lithologic types were not well shown, but structural features were noted that were not recognized in conventional photography at a scale of 1:62,500. It is concluded that radar imagery at this scale offers little help in differentiating small geologic units, but major rock units can be distinguished. N.E.N.

N70-38896*# Geological Survey, Menlo Park, Calif.
APPLICATION OF RADAR IMAGERY TO A GEOLOGIC PROBLEM AT GLACIER PEAK VOLCANO, WASHINGTON
Rowland Tabor Washington May 1966 4 p *Its* Tech. Letter NASA-26
(NASA Order R-09-020-015)
(NASA-CR-113312) Avail: CFSTI CSCL 08G

Conventional and radar aerial photographs are presented, and the contrast on the radar imagery between the highly reflective solid rock and the less reflective unconsolidated deposits is described. N.E.N.

N70-38897*# Geological Survey, Menlo Park, Calif.
PRELIMINARY GEOLOGIC MAP OF THE MONO CRATERS QUADRANGLE, CALIFORNIA
Ronald W. Kistler Washington 1 Sep. 1965 4 p *Its* Tech.

Letter NASA-9
(NASA Order R-146)
(NASA-CR-68346) Avail: CFSTI CSCL 08B

The geological map of the Mono Craters, Sierra Nevada, California, is prepared at a scale of 1:48,000. E.E.B.

N70-38898*# Geological Survey, Washington, D.C.
PRELIMINARY RESULTS OF AERIAL INFRARED SURVEYS AT PISGAH CRATER, CALIFORNIA
W. A. Fischer, J. D. Friedman, and T. M. Sousa 22 Apr. 1965 16 p *Its* Tech. Letter NASA-5
(NASA Order R-146)
(NASA-CR-62908) Avail: CFSTI CSCL 08E

Results are reported of aerial surveys utilizing the NASA remote sensing aircraft to test equipment under field conditions and to provide infrared imagery of the test site at various times of the day and from various spatial positions. Field measurements of surface temperatures and micro-relief, and laboratory measurements of reflectance were contrasted with measurements of film density on infrared images acquired at various times of the day. Measurements of microrelief were also contrasted with film densities of various materials imaged at increasingly oblique angles. Results suggest that unconsolidated materials possess a lower thermal inertia than consolidated materials, that unconsolidated materials emit larger quantities of infrared energy than consolidated materials when both are subjected to similar quantities of solar radiation, that film densities differ with angle of view, and that these relative quantities and changes in relative quantities of radiation may be observed from airborne platforms. S.C.W.

N70-38899*# Geological Survey, Menlo Park, Calif.
GEOLOGIC EVALUATION OF RADAR IMAGERY OF FLIGHTS 100-B AND 100-C ACROSS THE CENTRAL SIERRA NEVADA, CALIFORNIA
Paul C. Bateman Washington May 1966 9 p *Its* Tech. Letter NASA-27
(NASA Order R-09-020-015)
(NASA-CR-75525) Avail: CFSTI CSCL 08G

Aerial photographs taken on east-west flights are interpreted and evaluated. Topographic features resulting from volcanism, faulting, or lithologic control of erosion are distinguished. It is felt that radar photography is more useful for areas with vegetation and conventional color photography is more useful for desert and areas of bare-rock outcrops. N.E.N.

N70-38903# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
SEISMIC WAVE VELOCITIES AND EARTH STRUCTURE ON THE AFRICAN CONTINENT
Frank Gumper and Paul W. Pomeroy (Michigan Univ., Ann Arbor) 17 Nov. 1969 21 p refs Prepared in cooperation with Michigan Univ., Ann Arbor
(Contracts F44620-69-C-0060; AF 49(638)-1723)
(AD-707515; LDGO-1471; AFOSR-70-1641TR) Avail: CFSTI CSCL 8/7

Phase and group velocities of seismic surface waves were determined for the African continent. Rayleigh wave phase velocities range from approximately 3.90 to 4.20 km/sec in the period range of 30.0 to 63.0 sec. Group velocities of fundamental mode Love and Rayleigh waves in the period range of 10.0 to 60.0 sec range from 3.35 to 4.15 km/sec and 3.00 to 3.85 km/sec respectively. As expected, for the shorter periods the velocities depend strongly upon regional structure. Group velocities of sedimentary Rayleigh waves and of higher mode Rayleigh waves have also been determined. Short period body-wave velocities were determined for this region. Author (TAB)

N70-38907 Michigan Univ., Ann Arbor.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE STABLE AND MID-LATITUDE RED ARC (SAR-ARC)
Raymond Gerald Roble (Ph.D. Thesis) 1969 281 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 69-18093

The stable mid-latitude red arc is theoretically and experimentally examined in order to determine the nature of the arc and its role as a neutral gas heat source in the upper atmosphere during geomagnetic storms. The SAR-arc is considered to be excited by energy flowing from the magnetosphere down along the geomagnetic field lines into the ionosphere. The energy heats the ambient F-region electrons which in turn excite atomic oxygen by electron impact and gives rise to the 6300 A emission characteristic of the SAR-arc. A two-dimensional model of the SAR-arc is constructed and the neutral heating rates for this model are used to calculate the neutral temperature increase and the atmospheric winds generated by the arc. The results indicate that a large thermal cell develops within the arc region and the peak neutral gas temperature increase within the arc is less than 70 K for a 10 kilorayleigh SAR-arc. The calculated circulation pattern generated by the SAR-arc is shown to produce certain atmospheric and ionospheric effects which are found to agree well with direct measurements made on satellites. Dissert. Abstr.

N70-38919# Saclant ASW Research Center, La Spezia (Italy).
MODIFICATIONS TO THE SACLANTCEN SPHINCTER CORER
Claude Gehin, Pierre Blavier, and Bruno Matteucci 15 Mar. 1969 14 p refs
(Saclantcen-TR-112-Suppl) Avail: CFSTI

Modifications to the Saclantcen Sphincter Corer with recoilless piston reported in Saclantcen-TR-112 are described. These allow the interval between corings to be halved to about one hour and simplify the maintenance. Author (ESRO)

N70-38920# Saclant ASW Research Center, La Spezia (Italy).
A RECOILLESS PISTON FOR THE SACLANTCEN SPHINCTER CORER
A. Kermabon and U. Cortis 15 May 1968 27 p refs
(Saclantcen-TR-112) Avail: CFSTI

A modification to the Saclantcen "Sphincter Corer reported in Saclantcen-TR-34 is described. It consists of a simple system for positioning the piston relative to a fixed platform lying on the sea floor, thereby eliminating recoil during deep-sea coring. Author (ESRO)

N70-38926*# Geological Survey, Denver, Colo.
A DISTINCTION BETWEEN BEDROCK AND UNCONSOLIDATED DEPOSITS ON 3-5 MU INFRARED IMAGERY OF THE YELLOWSTONE RHYOLITE PLATEAU
Robert L. Christiansen May 1968 8 p refs
(NASA Order R-09-020-015)
(NASA-CR-94415; NASA-104) Avail: CFSTI CSCL 08G

Infrared imagery covering most of Yellowstone National Park was obtained in August 1966, using the Reconofax 4 system in an aircraft flying at about 20,000 feet. This imagery was examined in order to evaluate the geologic information it contains in relation to a study of the Yellowstone rhyolite plateau. As most of the findings contained no new information about the capabilities of the system, they are reviewed briefly. One particular aspect of the interpretation, a clear local distinction between bedrock and superficial deposits, was noted. Author

N70-38928*+ Geological Survey, Menlo Park, Calif.
TOPOGRAPHIC STUDIES OF PISGAH CRATER, CALIFORNIA

R. E. Altenhofen, J. K. Oman, and T. M. Sousa Washington 25 Jun. 1965 109 p *Its* Tech. Letter NASA-7
(NASA Order R-146)
(NASA-CR-63699) Avail: CFSTI CSCL 08E

Topographic information on two sets of sub-areas within the Pisgah Crater, California are presented. The first set of sub-areas consists of two flight paths which were used to study multispectral photography, color photography, and infrared imagery. Information furnished on these flight paths consists of the numerical designation, position, and altitude of a series of wing and centerline points surveyed and targeted in the field. The second set of sub-areas was used by radar investigators. Information furnished on these areas includes plots showing the altitude and spacing of corner and intermediate points, surveyed and targeted in the field; and the location of a series of topographic profiles developed by photogrammetric means. Mosaics of aerial photographs showing sub-areas and the location of the corner and intermediate points, topographic profiles of the sub-areas at a scale of 1:600, and a description of procedures used are included. R.N.A.

N70-38929*# Geological Survey, Washington, D.C.
HYDROLOGIC EVALUATION OF GEMINI PHOTOGRAPHS OF FRINGES OF THE SAHARA, AFRICA
J. R. Jones Apr. 1967 16 p *Its* Tech. Letter NASA-68
(NASA Order R-09-020-013)
(NASA-CR-84588) Avail: CFSTI CSCL 08H

Five Gemini color photographs, including one from Gemini 4, three from Gemini 5, and one from Gemini 9, are evaluated for their content of information of hydrologic significance. Geographic, geomorphic, and geologic features are annotated on overlays. Outstanding features clearly displayed in the photos include the paleohydrologic (transitional) nature of the eastern shore of Lake Chad; topographic and color manifestations of geology near the Atlantic Coast of Morocco, and the hydrologic control on location of towns in that region (37 towns were located in one photograph); the sharp contrast between the water-rich Nile Delta and adjacent desert; the disappearance of the Jabal Nafusah escarpment in Libya; and the intricate drainage patterns of the flat-lying beds which form the Jabal Nafusah. Author

N70-38933*# Geological Survey, Washington, D.C.
EVALUATION OF NIMBUS VIDICON PHOTOGRAPHY—SOUTHWEST FRANCE AND NORTHEAST SPAIN
Edward G. Hasser Oct. 1966 16 p *Its* Tech. Letter NASA-53
(NASA Order R-09-020-011)
(NASA-CR-78781) Avail: CFSTI CSCL 08G

Southwest France and much of the Pyrenees are in a humid region and most of northeast Spain is arid or semiarid. The vegetation is the principal image maker. Its images are modified, particularly in southwest France, by terrain and cultural influences, such as plains and mountains, and the suitability of the terrain for irrigated and nonirrigated agriculture. The vegetation tends to mask landform boundaries, geology, and stream lines. Tones are lighter in the arid and semiarid regions and, therefore, slopes and stream beds are more noticeable in northeast Spain. Author

N70-38934*# Geological Survey, Washington, D.C.
GEOLOGICAL EVALUATION OF NIMBUS VIDICON IMAGERY—NORTHWEST GREENLAND
William E. Davies Oct. 1966 15 p refs *Its* Tech. Letter No. NASA-56
(NASA Order R-09-020-011)
(NASA-CR-78776) Avail: CFSTI CSCL 08G

Two photos of Nimbus vidicon imagery cover northwest Greenland. They are characterized by extreme contrast between ice and land. Apparently exposure was keyed to the ice and as a result no tonal quality gradation exists on the land; also long shadows cover the lowlands. Because of this, the imagery contains little of geologic value. The extreme contrast emphasizes some valleys reflecting structural control and it is possible to discern major structural features. Scale distortion is small but relief on snow and ice is greatly exaggerated. Author

N70-38935*# Geological Survey, Washington, D.C.
GEOLOGICAL EVALUATION OF RADAR IMAGERY, APPALACHIAN PIEDMONT, HARFORD AND YORK COUNTIES, MARYLAND AND PENNSYLVANIA
David L. Southwick Oct. 1966 15 p *Its* Tech. Letter No. NASA-48
(NASA Order R-09-020-015)
(NASA-CR-78778) Avail: CFSTI CSCL 08G

Radar imagery of Harford County, Maryland and adjacent parts of York County, Pennsylvania was flown on August 20, 1965. Horizontally polarized high-frequency side-looking radar was employed and two images were produced from horizontally and vertically polarized components of the return signal. Overlapping strips covering about 700 sq. mi of country were obtained. The scale varies but is approximately 1:200,000. The area surveyed contains a wide variety of metamorphic and igneous rocks that for the most part are deeply weathered and mantled by saprolite and soil. In general the topography is low and rolling with steep slopes only near incised major streams. Much of the county is farmed and the remainder is covered with hardwood forest. The radar imagery reveals neither soil-lithologic variations nor linear features. Author

N70-38936*# Geological Survey, Menlo Park, Calif.
PHOTOGEOLOGIC INTERPRETATION OF GEMINI 4 COLOR PHOTOGRAPHY: BAJA, CALIFORNIA
Rowland Tabor Washington May 1966 7 p *Its* Tech. Letter NASA-24
(NASA Order R-09-020-015)
(NASA-CR-75447) Avail: CFSTI CSCL 08G

The color photographs from Gemini 4 were taken with a hand held Hasselblad camera with a focal length of 80 mm (f 2.8). The space vehicle was about 180 miles above the surface of the earth when passing over Baja, California and the photographic prints, used in this study, have a scale of about 1:640,000. The photograph selected for the study is essentially vertical, has no obscuring clouds and is centered over a desert area in Baja, California. Geologic features are well displayed. Conventional photogeologic methods were employed to convert the photograph into a geologic map. The major rock units were traced directly from the photograph but the interpretation was made with a stereopair under magnification. Author

N70-38937*# Geological Survey, Menlo Park, Calif.
RADAR IMAGERY: SALTON SEA AREA, CALIFORNIA
Edward W. Wolfe Washington May 1966 16 p refs *Its* Tech. Letter NASA-29
(NASA Order R-09-020-015)
(NASA-CR-75452) Avail: CFSTI CSCL 08G

Radar imagery of the Salton Sea area of southern California was obtained in November 1965. Polarized and depolarized images at a scale of approximately 1:160,000 were studied. Although the two types of imagery are close in quality, the polarized image shows slightly greater tonal contrast and is less obscured by noise, which appears on the depolarized imagery as banding parallel to the line of flight. Segments of the polarized imagery are reproduced. Author

N70-38938*# Geological Survey, Denver, Colo.
GEOLOGICAL EVALUATION OF RADAR IMAGERY OF THE SPANISH PEAKS REGION, COLORADO
Ross B. Johnson Washington Oct. 1966 14 p refs *Its* Tech.

Letter No. NASA-47
(NASA Order R-09-020-015)
(NASA-CR-78779) Avail: CFSTI CSCL 08G

The area of the radar imagery strip extends from Alamosa to Aguilar, Colorado at the latitude of the Spanish Peaks. Inspection of the radar image revealed conspicuous northwest-southeast striking lineaments in Tertiary sedimentary rocks of continental origin. These lineaments do not show on aerial photographs, and were not recognized on the ground during field mapping. Radar imagery, at least of the quality of this strip, does not seem to be adequate for geologic mapping. Flat-lying beds cannot be distinguished from vertical beds; Paleozoic sedimentary rocks, and semi-consolidated Tertiary gravels are not distinctive. Folds and faults, even of regional size, cannot be seen. However, the dikes associated with the Spanish Peaks are well displayed. Radar imagery may be more useful in geomorphic and physiographic investigations. Author

N70-38939*# Geological Survey, Menlo Park, Calif.
INFRARED IMAGERY OF PART OF THE HIGH CASCADE RANGE AND McKENZIE RIVER VALLEY, OREGON
Donald A. Swanson Jun. 1967 21 p refs *Its* Tech. Letter NASA-76
(NASA Order R-09-020-015)
(NASA-CR-85276) Avail: CFSTI CSCL 08G

Continuous infrared imagery in the 3 – 5 micron band was obtained by airplane during a south to north overflight on August 14, 1966. The image strip is 3 – 4 miles wide and extends from 18 miles south of Crater Lake northward to North Sister and McKenzie Pass, where it veers westward and follows McKenzie River as far as its confluence with Willamette River. The infrared imagery is evaluated in terms of physical (principally geologic) and cultural features as portrayed on published geologic maps. The flight was at an altitude of 16,000 feet, and the ground surface varied from a few hundred to over 10,000 feet. The scale of the imagery is approximately 1:81,000 in a direction parallel to the flight path. Normal to the flight path the scale progressively decreases away from the center line of the imagery strip because of the scanning methods. The image is distorted as a consequence of the variable scale, and ground features are foreshortened toward either edge of the recording film. Author

N70-38941*# Geological Survey, Menlo Park, Calif.
GEOLOGIC EVALUATION OF INFRARED IMAGERY OF HIGHLY FAULTED VOLCANIC TERRANE IN SOUTHEAST OREGON
George W. Walker Jun. 1967 19 p refs *Its* Tech. Letter NASA-77
(NASA Order R-09-020-015)
(NASA-CR-85272) Avail: CFSTI CSCL 08G

Nearly continuous infrared imagery in the 3-5 micron band, obtained from a single west to east overflight 20-30 miles north of the Oregon border and extending from Grants Pass through the Cascade Range to the Idaho border, is compared empirically with recently prepared geologic maps. Both geologic and cultural features shown on the IR imagery are evaluated and comparisons are made with K band radar imagery of the area near Hart Mountain, Lake County, Oregon. No surface temperature measurements have been made, nor are any data available on the emissivity of the surface materials, so that comparisons and discussion of results are entirely qualitative. Author

N70-38942*# Geological Survey, Washington, D.C.
RADAR IMAGERY: PARMACHENEE LAKE AREA, WEST CENTRAL MAINE
D. S. Harwood Jun. 1967 16 p refs *Its* Tech. Letter NASA-81
(NASA Order R-09-020-015)
(NASA-CR-85279) Avail: CFSTI CSCL 08G

Radar imagery was used to study the topography of the Parmachenee Lake area, which extends from the Maine-New Hampshire border northeast along the international border between Quebec and Maine to the Chain Lakes area of Maine. The radar photographs show the influence of resistant bedrock units on topography far better than existing aerial photographs. However, there is no indication that the radar beam can distinguish rock types in any way other than by their topographic expression. There is also little indication that the radar beam can penetrate the dense foliage. However, it is very effective in distinguishing evergreen from deciduous trees. The chief advantages of radar imagery are enhanced topographic expression of resistant bedrock units, continuous strip coverage, and all-weather capability. R.N.A.

N70-38943*# Geological Survey, Menlo Park, Calif.
GEOLOGIC EVALUATION OF RADAR IMAGERY OF THE CENTRAL PART OF THE OREGON HIGH CASCADE RANGE
D. A. Swanson May 1966 19 p refs
(NASA Order R-09-020-015)
(NASA-CR-76691) Avail: CFSTI CSCL 08G

Continuous radar imagery was flown in conventional aircraft from about the northern boundary of Crater Lake National Park, Oregon, northward to Black Butte and return. Both like and cross polarized images were obtained. This report evaluates geologic features shown on the imagery as compared with the known geology shown on published maps, especially in a small (100 mi sq) area of youthful volcanism near South Sister. Author

N70-38945*# Geological Survey, Washington, D.C.
GEOLOGICAL STUDIES OF THE EARTH AND PLANETARY SURFACES OF ULTRAVIOLET ABSORPTION AND SIMULATED LUMINESCENCE
William R. Hemphill and Roger Vickers (IIT Res. Inst., Chicago, Ill.) Apr. 1966 70 p refs *Its* Tech. Letter NASA Suppl-33A
(NASA Order R-146-09-020-006)
(NASA-CR-75909) Avail: CFSTI CSCL 08G

Laboratory and field studies are being conducted to determine the significance of ultraviolet spectral reflectance and stimulated emission measurements in discriminating between surface features and materials, initially from aircraft altitudes, and later from earth and lunar orbit. Laboratory studies have included ultraviolet reflectance and emission measurements of common rocks and rock forming minerals at wavelengths as short as 2200 A. These studies suggest that although less energy is reflected by some natural materials in the ultraviolet than in the visible spectrum, contrast for some materials imaged at 2500 A exceeds image contrast of the same materials at longer wavelengths. This work was extended into the vacuum ultraviolet. Airborne tests with an optical-mechanical line scanner equipped with an ultraviolet sensitive photomultiplier detector yielded long wavelength ultraviolet imagery of several geologic and agricultural test sites. Studies outlining constructional and operational constraints of suitable imaging and spectrometer systems for detecting ultraviolet reflectance and luminescence of terrestrial and lunar materials from orbital altitude were completed. R.N.A.

N70-38968 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ANNUAL VARIATION OF THE ZONAL CIRCULATION
V. Sarov 24 Jun. 1970 6 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), v. 31, 1968 p 26 – 29
(NLL-M-9196-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Atmospheric circulation index annual variations are calculated based on parameters including atmospheric turbulent mixing, vorticity, angular velocity, temperature gradients, and pressure.

Laplace transformations, Legendre functions, and Boltzmann distributions are included in the calculations. Theoretical and climatic data are compared in a figure of circulation index annual variations.
J.M.

N70-38974*# Geological Survey, Denver, Colo.
EXTENT OF RELICT SOILS REVEALED BY GEMINI 4 PHOTOGRAPHS
Harald Drewes and Roger Morrison Oct. 1966 19 p *Its* Tech. Letter NASA-60
(NASA Order R-09-020-011)
(NASA-CR-78775) Avail: CFSTI CSCL 08G

Synoptic observations of large areas, recorded in photographs taken from the Gemini 4 mission, indicate that color photographs from orbital altitudes offer certain unique advantages for determining the extent, correlation, and development of some types of soil. Reddish soils are the most conspicuous ones on the photographs and in general are old soils, that developed during intervals of reduced erosion and surficial deposition favorable for chemical weathering. Correlation of these soils would be a major factor in correlating Quaternary geologic events in separate drainage basins of the southwest with known interglacial events to the north.
Author

N70-38975*# Geological Survey, Denver, Colo.
AN EVALUATION OF THE GEMINI 4 COLOR PHOTOS OF THE GULF OF CALIFORNIA-CENTRAL TEXAS AREA
Harald Drewes Oct. 1966 17 p *Its* Tech. Letter NASA-46
(NASA Order R-09-020-013)
(NASA-CR-78774) Avail: CFSTI CSCL 08G

On the Gemini 4 mission a series of overlapping photographs were taken June 5, 1965, from the Gulf of California to central Texas. The photographs chief value to geological interpretation lies in their fine definition of surficial deposits and some younger volcanic rocks. They also show, in a much less reliable way, some kinds of older sedimentary and igneous rocks, and show a little of the geological structure of the regions. The photos in Texas are oblique shots, which sufficiently distort large portions to impair their value as a geological tool. Three areas are selected for review to illustrate what geological interpretations can be made of different geologic terranes.
Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-37650# California Univ., Livermore. Lawrence Radiation Lab.
METHOD FOR EVALUATION AND CERTIFICATION OF THE SHEFFIELD SMALL-RADIUS GAGE
Donald L. Lane Feb. 1970 18 p Sponsored by AEC
(UCRL-50815) Avail: CFSTI

The Sheffield Small-Radus Gage is a precision measuring machine used for inspecting small parts for inner/outer radius. The gaging range will accept parts up to 2.00 in. for either inner or outer radius. The basic components of the machine consist of: a precision rotary table which carries the part, a ball slide that is counterbalanced to follow the 2.00-in. travel of a supermicrometer, a precision spindle mounted to the ball slide, an electronic gage head mounted to the spindle to detect deviations in part radii, and a polar-chart recorder which records deviations as read by the gage head. Twelve evaluation and certification tests developed for the Sheffield Small-Radius Gage are reported. Photographs of each test setup are included.
Author

N70-37677# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
AN ULTRASONIC NONDESTRUCTIVE TESTER
J. C. Roubik 9 Mar. 1970 16 p ref
(Contract AT(29-2)-656)
(GEPP-80) Avail: CFSTI

Ultrasonic, nondestructive testing methods for the evaluation of raw stock and manufactured items are described. A semi-automatic test system is used to perform the evaluation. The system includes an X-Y-Z axis mechanical manipulator, X-Y data potentiometers, a combination 1000-Hz transducer pulser and 60 MHz bandwidth electronic pulse receiver-detector, a 5-gallon immersion tank, and a set of profiling balls. The system has the capability of detecting flaws of smaller size in thinner material and closer to the front surface than commercially available systems.
Author

N70-37686# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
DEVELOPMENT OF A GRADIOMETER FOR MEASURING GRAVITY GRADIENTS UNDER DYNAMIC CONDITIONS
Glen Kloiber Mar. 1970 49 p
(Contract F19628-69-C-0219)
(AD-707545; AFCRL-70-0267; SR-1) Avail: CFSTI CSCL 14/2

Design and development of a breadboard model of a gravity gradiometer has been undertaken by Hughes Aircraft Company under this Air Force Contract. This breadboard model, when developed, will be capable of measuring the gradient of the gravitational force field with any axis orientation under a quiet laboratory environment. The over-all goal of this program and succeeding ones is to develop a gradiometer capable of measuring gravitational force field gradients while being flown in an airplane. The report contains an up-to-date description of the design and development of the gradiometer and the design changes required as a result of preliminary tests. It also outlines a development plan which will resolve pertinent problems and assist in the achievement of the prototype operational goals.
Author (TAB)

N70-37689# ARO, Inc., Arnold Air Force Station, Tenn.
RESOLUTION LIMITS ON FRAUNHOFER HOLOGRAPHY Final Report, Jun. - Sep. 1969
Ronald A. Belz AEDC May 1970 71 p refs Prepared in cooperation with Tenn Univ., Tullahoma
(Contract F40600-69-C-0001)
(AD-706403; AEDC-TR-70-23) Avail: CFSTI CSCL 14/5

The resolution of an in-line hologram recorded with plane waves in the Fraunhofer region of a circular, opaque, particle is evaluated. From the diffraction integral for the reconstructed, real image the intensity distribution about the image is found. Criteria for determining the edge of the image in addition to determining the plane of focus are specified from the data, and the measurement accuracies are found. The inaccuracies are shown to be a result of the inability of the film to record all of the light diffracted by the particle. The reasons for this, film grain noise and its cutoff frequency and dynamic range, are explained and their relative effects compared for the various particle sizes and recording distances.
Author (TAB)

N70-37720# Lowell Technological Inst. Research Foundation, Mass.
FOURIER ANALYSIS AND NONLINEAR OPTICAL SYSTEMS
Adolph Baker and David Korff 1969 17 p refs
(Contract F33657-67-C-1662)
(AD-707464) Avail: CFSTI CSCL 20/6

The Modulation Transfer Function is based on Fourier techniques which imply the validity of the principle of superposition. This is clearly violated in the nonlinear film development process. It becomes necessary to face up to this question if one is to know how much confidence to place in conclusions resulting from such analysis of incoherently illuminated systems. A pseudotransfer function is defined to represent an artificial linear filter which, if it replaced the actual optical and photographic process, would result in precisely the same image as would be produced by the real system. The significance of such a function in a statistical approach and the results of a typical calculation are presented for purpose of illustration. Some of the conditions under which the atmospheric transfer function remains undefined are also reviewed. Author (TAB)

N70-37776# System Development Corp., Falls Church, Va.
EFFECTS OF IMAGE INCONGRUENCE ON LOCATION OF COMMON TERRAIN IN COMPARATIVE COVER
Sidney Epstein Arlington, Va. Behavior and Systems Res. Lab. Feb. 1970 32 p
(Contract DAHC19-67-C-0039)
(AD-707441; BESRL-TRN-222) Avail: CFSTI CSCL 14/5

The study was designed to determine the effects of differences in photo scale and orientation of early and late cover and of variation in percent of overlap on inventive error, completeness, and speed with which image interpreters identify the comparative cover photographs and confidence in reports. Personnel of the System Development Corporation and of the INTERPRETER TECHNIQUES Work Unit (BESRL) conducted an experiment in which 96 trained image interpreters were given the task of locating, on rolls of new photographic cover (late cover), frames depicting the same terrain as that presented in the early cover. There were 12 experimental conditions involving 2 levels of difference in photo scale (1:1 and 1:2), 3 levels of variation in orientation (identical or 0, 30, and 180 degrees) and 2 levels of percent of overlap (100% and 50%). A Graeco-Latin square counterbalanced arrangement was employed in presenting the subjects (24 groups of 4 interpreters each) with the search rolls and the early cover frame. Interpreter performance was measured in terms of the following criteria: Time--number of seconds to locate the relevant late cover frame, Frame Location Completeness--percent of relevant search roll frames correctly selected, Inventive Errors--number of frames incorrectly selected, and Confidence--expression of self-confidence in responses rated on a 3-step scale. Author (TAB)

N70-37788# Joint Publications Research Service, Washington, D.C.
SOME INSTRUMENTAL ERRORS OF GYROSCOPES
M. A. Pavlovskiy *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 1 – 4 refs (See N70-37787 21-21)
Avail: CFSTI

Estimates are made of specific examples of increases of axial and centrifugal moments of inertia of the frame of a Cardan suspension arising from static balance of the instrument, and also the centrifugal moment of inertia of the rotor arising from inaccurate dynamic balancing of it. Author

N70-37791# Joint Publications Research Service, Washington, D.C.
ERROR INFLUENCE OF A REAL ACCELEROMETER ON THE MEASURING ACCURACY OF ANGULAR VELOCITY
V. I. Lopatin *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 18 – 23 refs (See N70-37787 21-21)
Avail: CFSTI

Consideration is given to errors in the measurement of components of the angular velocity of a moving object with the aid of an existing accelerometer mounted on the rotor, when its sensitive axis is parallel to the rotation axis and the angular rotation velocity is not stable. Curves are presented for the dependence of measurement errors on the measured values of angular velocity. Author

N70-37792# Joint Publications Research Service, Washington, D.C.
CALCULATION OF THE AERODYNAMIC DRAG MOMENT FOR A GYROMOTOR OPERATING IN AIR
B. A. Delektorskiy et al *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 24 – 30 (See N70-37787 21-21)
Avail: CFSTI

Engineering calculations of aerodynamic drag moments of gyromotors operating in air are presented. Calculations are based on formulas obtained as a result of experimental investigations. Author

N70-37793# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF THE ELECTROMECHANICAL MOMENT OF A GYROMOTOR ON THE SYSTEMATIC DRIFT OF A TRIAXIAL GYROSTABILIZER
V. S. Slepkov *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 31 – 37 refs (See N70-37787 21-21)
Avail: CFSTI

The operation of a triaxial gyrostabilizer in the presence of oscillations of the platform is considered. The equations of motion of the rotor of a two-degree gyroscope are formulated with consideration of electromechanical moments of the motor for the case of synchronous and asynchronous gyromotors. It is shown that the moment of the gyromotor leads to additional drift of the stabilized platform. Author

N70-37794# Joint Publications Research Service, Washington, D.C.
DETERMINATION OF MAGNETIC MOMENT OF MAGNETIZED GYROSCOPE
I. A. Ushakov *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 38 – 44 refs (See N70-37787 21-21)
Avail: CFSTI

A formula is obtained for calculating the magnetic moment of a gyroscope by the substitution of a cylindrical gyroscope of equivalent ellipsoid of rotation. Author

N70-37796# Joint Publications Research Service, Washington, D.C.
DRIFTS OF A GYROSCOPE ON A ROTATING BASE
V. P. Vedenin *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 53 – 60 refs (See N70-37787 21-21)
Avail: CFSTI

An investigation is made of the equations for a three-degree astatic gyroscope. Results are obtained for determination of the drift of the gyroscope. Author

N70-37797# Joint Publications Research Serivce, Washington, D.C.
ON THE APPLICATION OF SELF-ADJUSTING SYSTEMS IN DIRECTIONAL GYROSCOPES
V. P. Demidenko et al *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 61 – 66 refs (See N70-37787 21-21)
Avail: CFSTI

On the basis of precession theory of gyroscopic instruments, the possibility of using a self-adapting system for increasing the accuracy of directional gyroscopes is examined. Author

N70-37865# Army Electronics Command, Fort Monmouth, N.J.
NEW INFRARED DETECTOR USING MICROWAVE TECHNIQUES
Paul A. Locke and Harold Jacobs Jun. 1970 21 p refs
(AD-706826; ECOM-3256) Avail: CFSTI CSCL 17/5

A device is described whereby reflections from a semiconductor block placed in a waveguide are used to measure the photon flux incident on the semiconductor. A germanium sample with associated circuitry acts as a tuned cavity whereby in the null condition complete absorption occurs. As light changes the semiconductor conductivity, changes in reflected power provide a sensitive indicator. Computer calculations have been worked out in an exact analysis and the results are checked with experiments. As a photo detector, this device may be competitive with state-of-the art components. If used as a research tool to study semiconductor properties the scheme has a great deal of sensitivity and flexibility.
Author (TAB)

N70-37909# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
SIGNAL-NOISE RATIO AND TIME RESOLUTION FOR NUCLEAR RADIATION SPECTROSCOPY USING SEMICONDUCTOR DETECTORS
H. J. Schuster Mar. 1969 63 p refs In GERMAN
(FMRB-15/69) Avail: AEC Depository Libraries

It is shown how the energy and time resolution can be improved in the measurement of the energy of radiation particles (nuclear spectroscopy) by the use of a new pulse former. For this purpose a typical measurement system (nuclear radiation detector, charge-sensitive preamplifier, linear amplifier, pulse former, and pulse-height analyzer) was described and its limits of energy and time resolution were studied. This study showed that these limits with semiconductor detectors are set principally by the noise of the amplifier. The total noise voltage behind the linear amplifier was analyzed. The signal-noise ratio and the resolution time were introduced as the measurement of the energy and time resolution, and the dependence of these magnitudes on the pulse former was derived. After a brief review of known pulse transformers, a time-dependent filter acting as a new pulse former was described and studied with respect to the signal-noise ratios and the resolution time.
Author (NSA)

N70-37943# Army Engineer Topographic Labs., Fort Belvoir, Va.
RACOMS PASS POINT MARKING AND MEASURING INSTRUMENT Engineer Design Test Report, Jul. 1968 -Jul. 1969
Eugene Taylor Jan. 1970 53 p
(AD-706828; USAETL-53-TR) Avail: CFSTI CSCL 8/2

This report covers the Engineer Design Test and evaluation of the Pass Point Marking and Measuring Instrument, a component of the Rapid Combat Mapping System (RACOMS). The Pass Point Instrument (PPI) is used to mark and measure points on aerial film or glass diapositives. An IBM 526 card punch and an Invac series 200 typewriter are used to record the coordinates of the marked points. The report concludes that: The equipment meets the requirements of the technical characteristics with respect to size of photography that can be accommodated, accuracy, electrical parameters, reliability, maintainability, and size; the equipment does not meet the production rate and the weight requirements of the technical characteristics; the instrument is suitable for the marking and measuring needed to perform an analytical triangulation solution in the field; and performance of this equipment could be improved by incorporation of the modifications enumerated in report.
Author (TAB)

N70-37990# Army Engineer Topographic Labs., Fort Belvoir, Va.
AN EVALUATION OF MULTIBAND AND COLOR AERIAL PHOTOGRAPHY FOR SELECTED MILITARY GEOGRAPHIC INTELLIGENCE IN A SUBTROPICAL DESERT ENVIRONMENT Technical Report, Jan. - Sep. 1968
Aulis O. Lind (Army Cold Reg. Res. and Eng. Lab.) Jan. 1970 109 p refs
(AD-707429; USAETL-54-TR) Avail: CFSTI CSCL 14/5

The objective of the work included in this report was to evaluate multiband and color photography with several film/filter combinations for their application to information extraction for Military Geographic Intelligence. Two studies were performed on aerial photography for which ground truth data was obtained in the Phoenix, Arizona, test area. One study concerned the derivation of terrain data from four film/filter combinations (Plus X with 47B, 58, and 25A filters; and Infrared with 89B filter). The second study was an evaluation of black-and-white, normal-color, and false-color imagery with regard to their information content. Details for each type of film/filter combination are given as well as a summary of the findings.
Author (TAB)

N70-38034# Coast Guard, Washington, D.C. Applied Technology Div.
THE FAR INFRARED LINE SCANNER AS A SMALL BOAT SEARCH SENSOR Final Project Report
James A. McIntosh 13 Apr. 1970 33 p refs
(AD-706708) Avail: CFSTI CSCL 17/5

A far infrared line scanner mounted in a P2E aircraft was used in a series of tests designed to provide quantitative data on the limits of detectablity of certain small craft under controlled conditions as a function of time of day, altitude, and slant range for currently available equipment. The test data agreed reasonably well with crude theoretical calculations. Under suitable conditions small craft can be detected by infrared scanners at ranges comparable to those at which they can be detected by eye, except that the infrared detection range is not diminished by darkness per se.
Author (TAB)

N70-38057# Technische Hochschule Aachen (West Germany). Physikalisches Inst.
A WIRE SPARK CHAMBER SPECTROMETER FOR ANALYSIS OF THE DECAY OF NEUTRAL K MESONS
N. Lehnart (Ph.D. Thesis) May 1969 747 p refs In GERMAN
(PITHA-30) Avail: AEC Depository Libraries

The mass difference between neutral K sub L and sub S mesons was measured in interference experiments and the phase of the CP-violated amplitude was determined. A digitalized wire chamber was used. The construction and properties of this chamber are described in detail. The experimental results are compared with the data of the superweak interaction model. The results are satisfactory.
NSA

N70-38096# Air Force Academy, Colo.
A DEFINITIVE ANALYSIS OF THE COMPATIBILITY OF THE MATERIALS USED IN THE APOLLO EXPERIMENT D008 PASSIVE DOSIMETER
Louis F. Wailly, Dennis L. Johnson, and Robert B. Weaver, ed. Apr. 1970 71 p refs
(AD-706095; USAF-TR-70-2) Avail: CFSTI CSCL 8/4

Four individual radiation dosimeters housed as a single unit were exposed to extreme environmental conditions to ascertain their stability for future manned space flights (D008 Experiment, Apollo Applications Program). Although these dosimeters are to be housed in a hermetically sealed container, the authors tested each dosimeter as though it were exposed individually within a space cabin in order to assure maximum confidence in its safety. These tests included total organic and carbon monoxide offgassing determinations in conjunction with IR scan and gas chromatographic analysis, thermogravimetric analysis, offensive odor test, and flash and fire propagation rate determinations. All individual dosimeters

satisfied NASA specifications for space cabin instrumentation. Finally, a helium leak test demonstrated the reliability of the sealed unit within which the dosimeters are to be housed. Author (TAB)

N70-38105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF OBTAINING FREQUENCY-CONTRAST CHARACTERISTICS OF PHOTOGRAPHIC FILMS
A. F. Melkanovich et al 21 Jan. 1970 8 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 13, no. 3, 1968 p 200–202
(AD-706175; FTD-HT-23-611-69) Avail: CFSTI CSCL 14/5

The modulation transfer function of a photographic film with antihalation treatment can be calculated as a frequency spectrum if the Frieser constant is known. It is suggested that the latter be determined by the maximum gradient of the function of the distribution of illumination across a knife-edge. It is shown that in order to obtain unambiguous parameters this function must be normalized. This approach has been tested experimentally. Author (TAB)

N70-38111# Radiochemical Centre, Amersham (England).
STANDARDIZATION OF RADIONUCLIDES BY EFFICIENCY-TRACING METHODS USING A LIQUID-SCINTILLATION COUNTER
D. G. Jones and A. Mc Nair *In* NBS Radioactivity Calibration Std. Aug. 1970 p 37–52 refs (See N70-38107 21-22)
Avail: SOD $1.25 Catalog No. C-13.10:331

Investigations into the behavior of the liquid scintillation counter system are discussed. The studies show that an analog of the system is possible which can provide accurate results for standardizing a number of low energy beta emitters by efficiency-tracing measurements. The results are obtained without having to make an unknown extrapolation outside the observable region of efficiencies. Author

N70-38132# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
NEUTRON DOSIMETRY IN THE ENERGY RANGE BETWEEN 10 AND 100 MeV
K. Tesch Feb. 1970 16 p refs
(DESY-70/5) Avail: AEC Depository Libraries

Two counting devices are described for neutron dosimetry in the energy range 10 to 100 MeV. The first is a scintillation counter with a liquid scintillator. The threshold is chosen in such a way that the correct response curve is given. Pulses from other particles are suppressed by pulse-shape discrimination. The second device is a single extension of the multi-sphere method. Some results of dose measurements in the mentioned energy range are briefly described. Author (NSA)

N70-38228# Oak Ridge National Lab., Tenn.
RADIOLOGICAL INSTRUMENT DESIGN INVESTIGATION FOR OCD Final Report, Feb. 1969–Jan. 1970
J. A. Russell, J. T. De Lorenzo, F. M. Glass, E. J. Kennedy, F. W. Manning et al 22 Apr. 1970 26 p
(Contract DAHC20-69-C-0132)
(AD-704803; ORNL-TM-2969) Avail: CFSTI CSCL 6/18

Circuit and electronic component design for Office of Civil Defense radiological instruments were studied. Three, transistorized, dc-to-dc converter power supplies were designed and test results are reported. Two electrometer amplifiers were designed to operate on these converters, and their theoretical operating time on one standard D cell is 500-3000 hr. Other activities reported are an investigation of integrated circuit techniques and their compatibility with circuit design, radiation effects on semiconductors, and an evaluation of D cell kits and a comparison of their capabilities with commercially manufactured cells. Author (TAB)

N70-38236# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
CONSTRUCTION AND INSTRUMENTATION OF A THREE-PARAMETER EXPERIMENT FOR INVESTIGATION OF THE PROMPT GAMMA RADIATION FROM FISSION FRAGMENT OF SPECIFIC MASS IN A TIME RANGE OF 1 NSEC AFTER A NEUTRON-INDUCED FISSION [AUFBAU UND INSTRUMENTIERUNG EINES DREIPARAMETEREXPERIMENTES ZUR UNTERSUCHUNG DER PROMPTEN GAMMASTRAHLUNG VON SPALTBRUCHSTUECKEN SPEZIFISCHER MASSE IN EINEM ZEITBEREICH VON 1 NSEC NACH NEUTRONENINDUZIERTER SPALTUNG]
F. Horsch and I. Piper Aug. 1969 24 p refs In GERMAN
(KFK-1003) Avail: AEC Depository Libraries

The special experimental difficulties which occur in the three parameter experiment and its installation on the reactor are described, and the solutions to the difficulties are given. Instrumental characteristics, such as time pulse decrease or pile-up reduction in the silicon detector branch are described individually. The methods used for the evaluation of the data are summarized and illustrated on some measurement results. The prompt gamma spectra are measured as a function of the mass and the kinetic energy of the fission fragments in flight. Author (NSA)

N70-38259# National Bureau of Standards, Washington, D.C.
TECHNIQUES IN CALORIMETRY. 1: NOBLE METAL THERMOCOUPLE FOR DIFFERENTIAL USE
Estal D. West *In its* Precision Meas. and Calibration Feb. 1970 p 111 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

Evaluated were thermoelectromotive forces of a thermocouple of gold-palladium and platinum-rhodium for use in calorimetric temperature measurements on one body at or near the temperature of another. A 20-junction thermophile was installed in the calorimeter with gold leads out to a cold junction and proved corrosion resistance and comparable sensitive. G.G.

N70-38264# National Bureau of Standards, Washington, D.C.
CONTINUOUSLY OPERATING HE3 REFRIGERATOR FOR PRODUCING TEMPERATURES DOWN TO .25 K
E. Ambler and R. B. Dove *In its* Precision Meas. and Calibration Feb. 1970 p 159–161 refs Submitted for publication Supported in part by AEC (See N70-38251 21-33)
Avail: SOD $5.00

A continuously acting, portable, He3 refrigerator is described. The He3 is recirculated in a system that operates without mechanical pumps. The throttling of the returning liquid is accomplished by means of porous plug. Good regulation is obtained by using a system that allows the pressure across the porous plug to vary with the circulation rate. The lowest temperature reached while circulating is 0.26 K at zero external heat input, and 0.40 K at 2mw. Author

N70-38265# National Bureau of Standards, Boulder, Colo. Cryogenics Engineering Lab.
APPARATUS FOR DETERMINATION OF PRESSURE DENSITY TEMPERATURE RELATIONS AND SPECIFIC HEATS OF HYDROGEN TO 350 ATMOSPHERES AT TEMPERATURES ABOVE 14 K
Robert D. Goodwin *In its* Precision Meas. and Calibration Feb. 1970 p 160–174 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

Method and apparatus are designed for more rapid determination of accurate, closely-spaced, PVT and specific heat

data than realized by previous procedures. A sequence of pressure-temperature observations at nearly constant density is made by a modified Reichsanstalt method. Temperatures of the essentially adiabatic piezometer are regulated by electric heating under control of the measuring thermometer. Instruments for measurement and control are integrated with a high-pressure calorimeter for compressed liquid and fluid. Calorimetric experimentation is accelerated by use of an electrode battery for the calorimetric heat supply and of a d-c power regulator developed for automatic shield control. Details are given of the PVT calibrations, adjustment computations, and comparisons with independent data. Author

N70-38280# National Bureau of Standards, Washington, D.C.
AN APPARATUS FOR MEASUREMENT OF THERMAL CONDUCTIVITY OF SOLIDS AT LOW TEMPERATURES
Robert L. Powell, William M. Rogers, and Don O. Coffin *In its* Precision Meas. and Calibration Feb. 1970 p 362-368 refs Submitted for publication (See N70-38251 21-23)
Avail: SOD $5.00

A description is given of an apparatus used for determining the thermal conductivities of solids in the temperature range 4 K to 300 K. The apparatus is especially suited to the determination of thermal conductivity over a large temperature interval, enabling coverage of the temperatures between the normal boiling points of liquefied gases. Illustrative results are given for an insulator, polytetrafluoroethylene, and for a high-conductivity commercial coalesced copper. The thermal conductivity of the insulator increases monotonically for 0.56 milliwatt per centimeter per degree K at 5 K, to 2.32 at 80 K. The thermal conductivity of the copper has a maximum of 24.9 watts per centimeter per degree K at 21 K, and a value of 8.15 at 5 K. The methods of data analysis and estimation of errors are given. Author

N70-38289 International Atomic Energy Agency, Vienna (Austria).
SOLID STATE NUCLEAR TRACK DETECTOR TECHNIQUES
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 61-71 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

It is shown that solid state nuclear track detectors are very suitable for some reactor physics experiments as measurement of intracell fission density and fast neutron flux distributions and further for determination of microscopic boron distributions in steel. Apart from this the method is used for absolute fast neutron fluence measurements in the JEEP II reactor. Other possibilities are left as measurement of reactor parameters. In comparison with activation detectors this new class of detectors has some special advantages as no decay of activity (tracks in mica for example are stable for millions of years) and higher sensitivity. Further these detectors are completely insensitive to gamma- and beta-radiation which is a special advantage in comparison with nuclear emulsions. Author

N70-38333# Uppsala Univ. (Sweden). Inst. of Physics.
AUTOMATIC SYSTEM FOR ANGULAR CORRELATION MEASUREMENTS
F. Falk, A. Linnfors, B. Orre, and J. E. Thun Dec. 1969 21 p refs
(UUIP-673) Avail: AEC Depository Libraries

A multipurpose angular correlation instrument with a versatile automatic controlling unit is described. The measuring program is executed by control of a punched card. This card is easily changed when a new measuring program is needed. A magnet allows the application of longitudinal and transverse magnetic fields up to 27 kG to the source. The temperature of the source may be varied. This instrument is suited for studies of both perturbed and unperturbed alpha-gamma and gamma-gamma angular correlations. For gamma-gamma measurements the detector configurations are restricted. Author (NSA)

N70-38353# Army Foreign Science and Technology Center, Washington, D.C.
SIGNAL MATCHING IN A RADIOINTERFEROMETER WITH INDEPENDENT RECEIVERS [OB ODNOY VOZMOZHNOSTI SOVMESHCHENIYA SIGNALOV RADIOINTERFEROMETERA S AVTONOMNYMI PRIEMNIKAMI]
V. A. Alekseyev at al 3 Mar. 1970 10 p Transl. into ENGLISH from Izuz Radiofizika (USSR), v. 11, no. 10, 1968 p 1477-1479
(AD-706485; FSTC-HT-23-084-70) Avail: CFSTI CSCL 14/2

A circuit for signal matching in a radio interferometer system of a large base with independent receivers and signal recording on magnetic tapes is considered. The matching is made on the target of a memory electron-beam tube with the scan rate control that compensates instabilities of the tape recorder velocities. The relative shift of recordings to find the zero reference is realized by a control of the scanning beginning moment. Author (TAB)

N70-38355# Los Alamos Scientific Lab., N.Mex.
COLOR FILM OUTPUT FROM COMPUTER RUNS
F. G. Berry, D. C. Buckner, R. C. Crook, and D. O. Dickman May 1970 21 p refs
(LA-4278-MS) Avail: CFSTI

Research and development progress for producing 35- and 16-mm color film output from the CDC 6600 computers is described. Advantages of color film output from computer runs, SC-4020 hardware modifications including a new color filter device, and color film processing are discussed. NSA

N70-38356# Panametrics, Inc., Waltham, Mass.
ULTRASONIC THERMOMETRY IN LMFBR SYSTEMS Progress Report, Mar. 1970
E. P. Papadakis, D. R. Patch, L. C. Lynnworth, and E. H. Carnevale Apr. 1970 8 p ref
(Contract AT(30-1)-3906)
(NYO-3906-10) Avail: CFSTI

The development of an ultrasonic system to measure temperature in the coolant, cladding, and fuel of liquid metal-cooled fast breeder reactors is described. The status of the BSR test of gamma radiation effects on a magnetostrictive transducer at high temperature and the status of the Oak Ridge Thermocouple Test are summarized. Also, development of an ultrasonic temperature sensor at the FFTF is outlined. NSA

N70-38379*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GLOBAL TIMING SYSTEMS OF NANOSECOND ACCURACY USING SATELLITE REFERENCES
Eugene F. Osborne Oct. 1969 195 p refs Sponsored in part by NASA
(Contract NOw-62-0604-c)
(NASA-CR-113097; AD-700661; TG-1086) Avail: CFSTI CSCL 14B

The application of artificial satellites in providing radio reference signals for the synchronization and calibration of local clock and timing systems has been studied. Space technologies in the specific areas of geodesy and navigation are applied with digital signaling techniques and atomic time and frequency standards. The result of the study predicts that a useful operational service can be provided on a global basis with a low-altitude polar satellite having an onboard atomic clock to most effectively satisfy user requirements at various levels of system accuracy. For fixed site users, system accuracies as good as 100 nanoseconds (rms) are realistic with sophisticated equipment and data processing. Author (TAB)

N70-38402# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
A 1/V DIELECTRIC TRACK DETECTORS FOR SLOW

NEUTRONS
W. W. Schultz Mar. 1970 43 p refs
(Contract W-31-109-eng-52)
(KAPL-M-7121) Avail: CFSTI

The fabrication of track detectors with boron atoms uniformly dispersed throughout the volume of the track detector material has been successfully accomplished. Because of their small size they have little effect on neutron flux one is trying to measure. It is possible to make measurements of neutron flux densities over a range of six to seven decades. Track density is found to be a function of the thickness of detector surface etched away and the ranges of the alpha particle and lithium recoil particle resulting from the capture of a neutron by a B-10 atom. As etching proceeds, track density may increase or decrease depending on the etching rate of the bulk material relative to the maximum etching rate perpendicular to the particle path. A new method of studying diffusion through thin layers at the surface of a solid is suggested. Author (NSA)

N70-38404# New Mexico Univ., Albuquerque, N. Mex. Dept. of Mechanical Engineering.
DEVELOPMENT OF MEASURING TECHNIQUES FOR ROCKET SLEDS Final Report, Dec. 1966 - Oct. 1969
William E. Baker and John C. Gustafson Holloman AFB, N. Mex. Air Force Missile Develop. Center Apr. 1970 171 p
(Contract F29600-67-C-0017)
(AD-706865; EE-166(69)HAFB-023; MDC-TR-70-11) Avail: CFSTI CSCL 14/2

Work is described which was undertaken to develop and improve techniques for measuring forces acting on rocket sleds. The Chaparral sled was instrumented and appropriate calibration made for measurement of vertical forces acting on the sled by the slipper. Resistance thermometers were also applied for measurement of temperature in the vicinity of the gage. A study of the accuracy of the Tech-2 sled transducer was made, and revised instrumentation applied in order to improve the accuracy. A force measuring system utilizing strain gages was developed for the modular monorail force transducer. Analytical studies of the response of a simple strain-gaged force link were made in order to better understand the behavior of the sled transducers under dynamic loading. The last area of work described is that of a highly accurate technique of differentiating analog data. Author (TAB)

N70-38494# Pittsburgh Univ., Pa.
ACCURACY OF RADIAL VELOCITIES DETERMINED WITH FIBER OPTIC ELECTROSTATIC IMAGE TUBE
W. R. Beardsley, J. K. de Jonge, Dora J. Haring, and J. R. Hansen (Westinghouse Res. Labs.) 1969 26 p refs *Its* Publ. Vol. 11, No. 1
(Grant NSF GP-8991)
Avail: Issuing Activity

The astrometric fidelity at the output face of a Westinghouse WL-30677 image tube is investigated. Stringent fidelity is required in order to provide accurate radial velocities of late-type IAU standard velocity stars. These standard velocities are achieved within the probable errors. A Baum test pattern was used to investigate the fidelity, and a performance gain of 16 was derived. Tables are presented of performance parameters of the tube as well as individual radial velocities. Author

N70-38540# Atomics International, Canoga Park, Calif.
LMFBR TASK 25, TRANSIT TIME FLOWMETER Quarterly Technical Progress Report, Jan. - Mar. 1970
15 May 1970 8 p refs
(Contract AT(04-3)-701)
(AI-AEC-12959) Avail: CFSTI

The development of a liquid metal flowmeter using cross-correlation techniques is summarized. Small temperature variations (thermal eddies) are detected at two points in the flow stream and the two signals are cross-correlated with a variable delay time. The delay time which gives maximum correlation is the transit time of the fluid between the sensors. NSA

N70-38602* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARTICLE BEAM MEASUREMENT APPARATUS USING BEAM KINETIC ENERGY TO CHANGE THE HEAT SENSITIVE RESISTANCE OF THE DETECTION PROBE Patent
Lionel V. Baldwin, and Virgil A. Sandborn, inventors (to NASA) Issued 24 Aug. 1965 (Filed 19 Jun. 1961) 5 p Cl. 324-106
(NASA-Case-XLE-00243; US-Patent-3,202,915; US-Patent-Appl-SN-118203) Avail: US Patent Office CSCL 14B

An apparatus for point or local particle beam power density detection and measurement is described. Because of the relatively small size of the detecting element, measurement is enabled with negligible distortion of the particle beam. The apparatus can determine the spreading of a particle beam and can detect and measure powerful density peaks. A probe consisting of a detecting wire positioned on electrically and thermally conductive rods is used to survey the particle beam. The detecting wire is immersed within the beam; impingement of the beam particles on the wire results in a conversion of beam kinetic energy into heat. The heat is conducted to the outer ends of the rods and dissipated, thereby maintaining the wire extremities at a substantially constant temperature and preventing destruction of the detecting wire. Means responsive to the electrical resistance variations of the wire are connected to the probe for developing an electrical signal indicative of the local power density of the beam. P.A.B.

N70-38717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTICS OF PHOTOGRAPHIC AND AERIAL PHOTOGRAMMETRIC INSTRUMENTS, CHAPTER 7
L. S. Urmakher 5 Mar. 1970 55 p refs Transl. into ENGLISH from Optika Fotograficheskikh i Aerofotogrammetricheskikh Priborov (Moscow), 1965 p 159 - 198
(AD-706202; FTD-MT-24-443-69) Avail: CFSTI CSCL 14/5

Intended primarily as a text-book for students of optics, the book discusses the basic principles of light, optical glass, the construction of images, and the optical systems employed in various photographic, photogrammetric, and geodetic instruments. Author (TAB)

N70-38718# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF SCIENTIFIC AND APPLIED PHOTOGRAPHY AND CINEMATOGRAPHY, VOLUME 1, NO. 3, 1969: Selected Articles
V. M. Bakhvalov et al 16 Mar. 1970 55 p refs Transl. into ENGLISH from Zh. Nauchn. Prikl. Fotogr. i Kinematogr. (USSR), v. 14, no. 3, 1969 p 168 - 173, 209 - 211
(AD-706354; FTD-MT-24-429-69) Avail: CFSTI CSCL 14/5

Contents: Investigation of separating ability of aerial films on colored and spectrozonal materials; High-resolving photographic materials; and Measurement of frequency-contrast characteristics of photographic materials. TAB

N70-38728# Aro, Inc., Arnold Air Force Station, Tenn.
TIME-MARKING HIGH-SPEED FILM IN MULTIPLE-CAMERA INSTALLATIONS Final Report, Jan. - May 1968
H. T. Kalb and F. L. Crosswy AEDC Jun. 1970 79 p refs
(Contract F40600-69-C-0001)
(AD-706852; AEDC-TR-70-168) Avail: CFSTI CSCL 14/5

The general time-event correlation problem for high-speed (10,000-frames/second), motion analysis cameras is discussed

The specific optics, sensitometry, and electronics problems involved in placing precise time and event marks on high-speed film, in addition to the design and development of an operational time and event signal generator, are discussed. The generator features a tuning fork time standard, integrated circuit timing logic that can furnish independent time and event signals for up to 15 cameras. A current ramp-film density wedge generator is presented as a novel method for relating time-mark lamp current amplitude to film-mark density. Recently developed, solid-state, light emitting diodes (LED) were investigated for application to the time-mark problem. The LED proved capable of providing time-marking pulses at rates in excess of 200 kHz. A technique for analyzing a waveform to operationally test the neon lamp timing circuit is evaluated. Author (TAB)

N70-38791# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH-SPEED SCANNING CAMERA WITH TWO REVOLVING RKD-2 DISKS

A. S. Dubovik et al 11 Mar. 1970 17 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 11, no. 2, 1966 p 111-117

(AD-706205; FTD-MT-24-462-69) Avail: CFSTI CSCL 14/5

A scanning camera with two revolving disks was developed, designated the RKD-2. The camera is useful in the filming of lengthy processes because it permits extending the overall time of recording by means of introduction of intervals of time between frames. The camera is very useful in cases where a high density of information is not necessary or particularly desirable. TAB

N70-38809# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.

AN INVESTIGATION OF THE MODE OF FAILURE FOR TWO LONG-LIFE THIN FILM VELOCITY SENSORS

Richard De Iasi, Gary Geschwind, and Kenneth Foreman Aug. 1970 34 p refs

(RM-484) Avail: CFSTI

The surface topography of two teflon coated long-life hot film velocity sensors that had failed during voyages of a research submersible was investigated with a scanning electron microscope. The protective teflon coating of one probe, which contained a high void density, had completely lifted away after 53 hours, whereas the second probe, which contained a relatively low void density, failed after approximately 830 hours of submerged exposure to the ocean. The results for these two probes suggest a direct correlation between the pore density in the teflon and the lifetime of the probe. A possible mechanism for the failure of these probes is proposed. Author

N70-38831# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SEMICONDUCTOR PRESSURE SENSOR FOR MEASURING STRONG SHOCK WAVES IN A LIQUID = OR > 1000 atm

V. K. Kedrinskii et al 1 Apr. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 4, 1969 p 92-94

(AD-706189; FTD-HT-23-51-70) Avail: CFSTI CSCL 14/2

A germanium-based semiconductor pressure sensor unit for measuring shock waves in the range 1000 to 10,000 atm is described and results of recording pressure in a hydrodynamic shock tube are given. Author (TAB)

N70-38833 Washington Univ., Seattle.

PRINCIPLES AND APPLICATIONS OF THE FLAME SCINTILLATION SPECTRAL ANALYSIS

Rudolf Franz Pueschel (Ph.D. Thesis) 1969 183 p

Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18310

The method of flame scintillation spectral analysis involves the study of light emitted when small particles are subjected to a high temperature. A theoretical expression based on statistical mechanics is presented for the rate of evaporation of solids in a flame. Derivations of values for crystal energies and flame temperatures which most strongly influence the vaporization rate are outlined. Calculations of the minimum particle size to give a significant signal to noise ratio for detection in the flame are described and are based on the solid decomposition rate together with intensity relationships and spectral characteristics of the photodetector. The main conclusion predicts that under typical flame conditions and ordinary particle sizes the intensity of emitted light is proportional to the particle surface area. The experimental part of the study describes design and construction of a flame scintillation spectrophotometer. Dissert. Abstr.

N70-38844*# Geological Survey, Washington, D.C. Topographic Div.

GEMINI PHOTOGRAPHY EVALUATION

Robert H. Nugent and Lowell E. Starr Mar. 1967 17 p *Its* Tech. Letter NASA-69

(NASA Order R-09-020-024)

(NASA-CR-85515) Avail: CFSTI CSCL 14E

As an initial effort to demonstrate a potential use of space photography for recording elements of the terrestrial environment, selected photographs from the Gemini IV and VII spaceflights were evaluated with respect to basic cartographic requirements. Author

N70-38854# Murray State Univ., Ky. Dept. of Physics.

A COMPUTER CONTROLLED BEAM-FOIL SPECTROSCOPY SYSTEM WITH AN APPLICATION TO ARGON

L. Bridwell, L. M. Beyer, W. E. Maddox, and R. C. Etherton [1970] 32 p refs Presented at 2nd Intern. Conf. on Beam-Foil Spectry.

Avail: CFSTI

A computer controlled system for the acquisition of beamfoil data is described. The system consists of a McPherson model 225 v ultraviolet monochromator equipped with a stepping motor on the grating drive, and connected to an IBM 1130 computer. An identical motor is used to step the foil position in lifetime measurements. System capabilities are discussed and preliminary data on argon acquired with the system are presented. Author

N70-38868# Du Pont de Nemours (E. I.) and Co., Circleville, Ohio. Research and Development Lab.

SAFETY ENCLOSURE FOR MERCURY FILLED MCLEOD GAGE

Ernest L. Lippert, Jr. and Joseph P. Glas [1969] 4 p refs

Avail: CFSTI

A McLeod gage box enclosure was fabricated from Lucite to prevent health hazards from mercury vapors when gages are broken. A hinged door with a magnetic catch covers the upper two-thirds of the front. The lower third, which is sealed to the box, helps to contain splashing mercury. Joints were sealed with a cement made by dissolving Lucite shavings in methylene chloride. Variations of the gage design are presented. After an accidental breaking of the gage, the mercury was contained within the box enclosure. E.H.W.

N70-38874# Saclant ASW Research Center, La Spezia (Italy).

A DEEP-SEA ELECTRICAL RESISTIVITY PROBE

A. Kermabon, C. Gehin, and P. Blavier 30 Apr. 1968 27 p refs

(Saclantcen-TR-115) Avail: CFSTI

An electrical resistivity probe is described that obtains in situ profiles of resistivity versus depth and thereby provides

measurements of the porosity and density in deep sea sediments. The probe, which is 13 m long and weighs 700 kg in water, is lowered by means of a simple wire rope and operates automatically after penetration, caused by its own weight, into the sea floor. Successive probings can be made while the ship is drifting or moving slowly. Good correlation has been obtained between electrical probe measurements and measurements made on cores taken nearby. Author (ESRO)

N70-38895*# Geological Survey, Washington, D.C.
EVALUATION OF NIMBUS 1 HIGH RESOLUTION INFRARED RADIOMETER (HRIR) IMAGERY
M. A. Conti Apr. 1967 19 p refs *Its* Tech Letter NASA-35
(NASA Order R-09-020-011)
(NASA-CR-85482; NASA-35) Avail: CFSTI CSCL 17E

Photographs of geologic features imaged by the high resolution infrared instrument aboard Nimbus I are evaluated. These features include volcanic and thermal zones, terrain-thermal reversals, thermal soil patterns, and polar ice features. It is noted that poor resolution, small scale, and other factors severely limit the quality of the imagery and the detectability of geologic features on a worldwide basis. Features that can be identified are discussed, and reasons are given for the quality of the photography which is considerably inferior to low-altitude imagery. C.T.C.

N70-38927*# Geological Survey, Washington, D.C. Topographic Div.
ULTRA-HIGH-ALTITUDE PHOTOGRAPHY COMPILATION EVALUATION
Robert H. Nugent Mar. 1967 10 p
(NASA Order R-09-020-024)
(NASA-CR-85483; NASA-73) Avail: CFSTI CSCL 08B

Black and white photography, taken at approximately 117,000 feet with a 6 in. focal length camera over Clark County, Nevada, was compiled into a topographic map with a Kelsh plotter. Analyses indicated that horizontal and vertical accuracy could be attained to meet map accuracy standards for compiling maps at 1:250,000 scale and possibly at 1:62,500. Author

N70-38940*# Block Engineering, Inc., Cambridge, Mass.
A MILLIMETER WAVELENGTH INTERFEROMETER SPECTROMETER Final Report
Geert Wyntjes and Neils O. Young [1966] 33 p ref *Its* Tech. Letter NASA-15
(NASA Order R-146; Contract USGS-13009)
(NASA-CR-75556) Avail: CFSTI CSCL 20F

A millimeter wavelength interferometer spectrometer was designed and theoretically evaluated for geological measurements. The design calls for the following performance characteristics: (1) bandwidth capability from 0.5 to 2 mm, and a rate of two scans per second; (2) a maximum resolution of 0.05/cm; and (3) a S/N per resolution element of approximately 150 for a 300 K black body source filling the f.o.v. and for an emissivity of 0.1. In addition, the instrument is to have a cryogenic detector and provisions for cryogenically cooling the optical system. Confidence is expressed that the fabrication of the instrument, called the bibath interferometer spectrometer, is feasible and that the specifications cited can be realized in an operational instrument. It is felt that the bipath instrument will be particularly useful for broadband spectral studies, such as atmospheric absorption measurements, terrestrial studies, and extraterrestrial emission measurements. The instrument as designed will be compact, lightweight, and will have good vibration tolerance. D.T.

N70-38944*# Geological Survey, Washington, D.C.
ULTRAVIOLET ABSORPTION AND LUMINESCENCE INVESTIGATIONS
William R. Hemphill and Samuel U. Carnahan (Westinghouse Elec. Corp., Baltimore) 16 Aug. 1965 71 p refs *Its* Tech. Letter NASA-6
(NASA Order R-146)
(NASA-CR-68748) Avail: CFSTI CSCL 17E

An ultraviolet imaging system was investigated for remote detection of luminescent minerals and rocks as well as for discriminating among nonluminescing materials on the basis of absorption of ultraviolet energy between 3300 A and 4100 A wavelengths. Basic operational components of the system include an ultraviolet transmitter employing a flying spot scanner, and an image dissector receiver. Luminescing minerals including deweylite, talc, dolomite, and calcite, were imaged at distances as great as 200 feet. Also, outcrops and terrain features were imaged by means of reflected ultraviolet light at distances as great as 75 feet. It was noted that some features, such as rock fractures and mineralized veins, seem to display more image contrast when imaged by reflected ultraviolet light than in natural light. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-37605# Naval Ordnance Lab., White Oak, Md.
EFFECT OF ULTRASOUND ON STRESSES DURING STRIP DRAWING
Alexander G. Rozner 6 Mar. 1970 28 p refs
(AD-707321; NOLTR-70-45) Avail: CFSTI CSCL 13/8

A technique was developed for studying effect of ultrasonic vibration on coefficient of friction between the rigid steel die and plastically deformed metal during strip drawing operation. It was observed that the stresses are substantially reduced when ultrasonic energy is introduced during the strip drawing process. Reduction in the coefficient of friction was also obtained with an application of ultrasound. The reduction in drawing stress is explained by superposition of the oscillatory stresses on the drawing stress. Author (TAB)

N70-37611# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORGINGS FROM SPECIAL STEELS: SELECTED CHAPTERS
I. G. Ganerson 20 Feb. 1970 126 p Transl. into ENGLISH from the book 'Pokovki Iz Spetsyalnykh Staley' Leningrad, Izd-Vo Mashinostroyeniye, 1967 p 1 - 153
(AD-706155; FTD-HT-23-1334-68) Avail: CFSTI CSCL 13/8

The book deals with problems connected with the production of forgings made of special steel used in power machinery manufacturing and in some other branches of the industry. Processes of forging the hard to deform steels are described and results of experimental research and experience gained in making forgings are analyzed. The quality of forgings is discussed in connection with conditions of their fabrication and practical recommendations on selecting rational technological processes are made. TAB

N70-37691# Sandia Corp., Albuquerque, N.Mex.
TROUBLESHOOTING ELECTRONIC WELDING PROCESSES
Mark J. Davis 10 Apr. 1970 9 p Presented at Interworks Metal Joining Conf., Chicago Sponsored by AEC
(SC-DC-70-4797; Conf-700506-1) Avail: CFSTI

An oscilloscope was used to monitor welding current and voltages. The capacitor discharge resistance, parallel gap resistance,

pulse spark spot, and percussive arc welding processes are discussed. Poor electrode geometry, power supply malfunctions, improper materials control, and lack of proper electrode followup during welding were ascertained as the main causes of welding failures. J.A.M.

N70-37790# Joint Publications Research Service, Washington, D.C.

DYNAMIC BALANCING OF ROTORS

V. Ye. Myachin *In its* AERON. Navigation Equipment 26 Aug. 1970 p 11-17 refs (See N70-37787 21-21)
Avail: CFSTI

The problem of combined determination and correction of unbalanced rotors is considered. The processes of locating and eliminating the unbalance and the establishment of prerequisites for the effective automation of all processes of dynamic balancing are included. Author

N70-37809 Saskatchewan Univ., Saskatoon.

A STUDY OF A TIME OPTIMIZED HYDRAULIC SERVOMECHANISM OPERATING UNDER CAVITATION CONDITIONS

Rudolph Manfred Lepp (Ph.D. Thesis) 1969 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-18652

A system in which extreme cavitation was allowed to occur, was studied. By tolerating cavitation it was possible to use a simple two mode subcontroller to optimize the transient response of the system. The study developed the subcontroller, incorporated it into the closed loop system and then determined what effect cavitation had on the dynamic performance of the system. The technique consisted of superimposing the load friction curve on the valve pressure-step-by-step, on this plane. The trajectory was then used to determine the phase-plane trajectory of the load. The displacement-time and velocity-time trajectories of the load were subsequently determined from its phase-plane trajectory. It was possible to include the effects of such system nonlinearities as the load friction, the valve pressure-flow characteristics, the valve hysteresis and dynamics of the valve. Leakage and oil compressibility were also considered in the analysis. Closed loop transient response tests were carried out by continuously cycling the system. Dissert. Abstr.

N70-37871# Army Electronics Command, Fort Monmouth, N.J.

COMPUTER PROGRAM FOR SYSTEM RELIABILITY

John R. Niemela, David Mandelbaum, and Harold Zell Mar. 1970 22 p
(AD-706827; ECOM-3267) Avail: CFSTI CSCL 14/4

A computer program for calculating the reliability of a system is presented with a brief discussion of the basic redundancy concepts and several examples with their appropriate data format and answer. In this respect, the discussion follows closely that presented in Army Material Command Pamphlet AMCP 703-3, Quality Assurance, Reliability Handbook, dated 28 October 1968. Author (TAB)

N70-37925* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CHECK VALVE ASSEMBLY FOR A PROBE Patent

Virgil S. Ritchie and Howard F. Ogden, inventors (to NASA) Issued 11 Jun. 1963 (Filed 27 May 1960) 5 p Cl. 73-384
(NASA-Case-XLA-00128; US-Patent-3,093,000; US-Patent-Appl-SN-32496) Avail: US Patent Office

An ambient atmospheric pressure sensing device is described which is insensitive to static-pressure errors resulting from attitude variations in diverse geometric planes. A segmented miniature assembly is provided which can be installed in a probe and which includes a group of constricted radial passageways arranged in circular rows. The assembly is connected to a pressure averaging chamber common to each row and valves are located in the passageways for selectively restricting the pressure in flow to the chambers. R.B.

N70-37953# City Univ. of New York.

ON THE OPTIMIZATION OF MASS DISTRIBUTION IN MECHANISMS

Richard Stanley Berkof (Ph.D. Thesis) 1969 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-19052

Force and moment balancing of certain plane mechanisms are considered. A new method, termed the Method of Linearly Independent Vectors, is shown to permit the exact force balance of simple linkages by making the total center of mass of each mechanism stationary. This is accomplished by redistributing the link masses in such a manner that the coefficients of the time-dependent terms of the equation describing the total center of mass trajectory vanish. Expressions for the shaking moment of unbalanced and force-balanced four-bar linkages with arbitrary link mass distributions are derived. Both translational and rotational mass effects are considered. The above expressions show that no internal mass redistribution can be found which permits perfect moment balance. In addition, it is shown that the shaking moment of a force-balanced four-bar linkage is invariant with respect to reference point. Dissert. Abstr.

N70-38018# Mechanical Technology, Inc., Latham, N.Y.

EVALUATION OF GAS BEARINGS FOR USE IN NAVAL MACHINERY UNDER CONDITIONS OF HIGH IMPACT

Alan Frost 28 Feb. 1970 61 p refs
(Contract N00014-66-C-0282)
(AD-706365; MTI-70TR11) Avail: CFSTI CSCL 13/9

A test machine, having a 65.5-pound rotor and employing gas-lubricated bearings, was experimentally subjected to impact testing while rotating at approximately 8000 rpm. The impact testing involved: (1) 1000 impacts on each of three bearing systems; (2) 30,000 low-level impacts on one bearing system; and (3) a series of high-level impact tests on one bearing system. Capacitance probe displacement transducers and accelerometers were used to measure dynamic responses throughout the test program. The impact tests identified further criteria that are considered to be important in the design of gas bearings for applications involving impact. Additional analysis and testing is now required to reduce these criteria to practical design procedures. The results demonstrate that gas bearings can be used under quite severe conditions of impact. Author (TAB)

N70-38020* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPARATUS FOR TRANSFERRING CRYOGENIC LIQUIDS Patent

Paul J. Sirocky, inventor (to NASA) Issued 25 Feb. 1964 (Filed 30 Mar. 1962, 6 p Cl. 62-55)
(NASA-Case-XLE-00345; US-Patent-3,122,000; U.S. Patent Office

An apparatus is described which can be used for transferring cryogenic liquids under zero gravity conditions and which also operates as a reservoir for the liquids with a minimum of heat transfer properties. The apparatus employs flexible bladder made of polyethylene terephthalate polyester or a polyhaloethylene resin, which maintains its flexibility at low temperatures and which can be collapsed under gaseous pressure to expel the desired amount of liquid. This flexible container is provided with a conduit for filling and expelling the cryogenic fluid. A zone surrounding the container has the dual function of insulating the liquid and effecting its

transfer. The bladder is placed within a rigid larger container of similar configuration. Affixed to the larger container is a conduit for instituting a vacuum in the zone between the two containers, for heat transfer reduction during storage. A rigid inner housing, the wall of which is substantially contiguous with the bladder in its normally expanded state, contains an aperture for gaseous communication between the outer container and the outside surface of the flexible container. P.A.B.

N70-38067# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF CLEANING, DEGASSING, AND EVACUATION IN VACUUM ENGINEERING
N. V. Cherepnin 15 Apr. 1970 357 p refs Transl. into ENGLISH from Osnovy Ochistki, Obezgazhivaniya i Otkachki v Vakuumnoi Tekhn. (USSR), 1967 p 1-408
(AD-707113; FTD-HT-23-109-69) Avail: CFSTI CSCL 13/8

The book presents a comprehensive and systematic study of the fundamentals of cleaning, degassing, and evacuation of vacuum devices and mechanisms. The extensive experience, scattered over current Soviet and foreign scientific and technical literature, is summarized and supplemented by new original interpretations of physical mechanisms of these complex processes of electrovacuum technology. Author (TAB)

N70-38139# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
ASYMPTOTIC PERFORMANCE OF A SYSTEM SUBJECT TO CANNIBALIZATION
Warren M. Hirsch and Herman Hanisch May 1970 35 p refs Presented at the NATO Conf., Luxembourg, May 1970
(Contract N00014-67-A-0467-0004)
(AD-707388; IMM-382) Avail: CFSTI CSCL 15/5

The document considers the performance of a system composed of n machines, each machine being composed of parts (or modules) of r different types arranged in series. If S sub i denotes the number of parts of type i functioning at a given moment, it is assumed that the performance level phi of the overall system at that moment is given by an equation showing the limits of S sub i at a minimum point. A collection of identical structures (ships, aircraft, missile batteries, etc) exemplifies the kind of system involved, under the assumption that each part in a given structure is essential to the performance of that structure. Limit theorems are proved which make it possible to evaluate explicitly the asymptotic performance level of the system under three different assumptions. Author (TAB)

N70-38147*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PARALLEL GAP WELDING
A. M. Pasciak 9 Sep. 1969 40 p refs
(NASA-TM-X-53876; MSFC-IN-R-QUAL-67-6) Avail: CFSTI CSCL 13H

Presented are general information and fundamental requirements of parallel gap welding of low power electronic micro-components to weldable printed wiring boards. Author

N70-38219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Packaging Evaluation Agency.
CYLINDRICAL CORNER PAD EVALUATION
John B. Knueven Dec. 1969 14 p
(AD-706889; Rept-69-9-D-102) Avail: CFSTI CSCL 13/4

This report is concerned with the evaluation of cushioning properties of cyclindrical corner pads cut from a pre-foamed cylinder, six inches in diameter of polyethylene (2pcf density) foam. The purpose of the project was to compare the performance characteristics of cylindrical corner pads versus conventional rectangular pads. The free-fall drops were performed in accordance with Fed. Std. 101A, Method 216. Cylindrical corner pads split under a test load of approximately 40 pounds. Definite signs of weakness were revealed at the seams. The cylindrical corner pads were considered inferior to the conventional rectangular corner pads and unsuitable for use with loads comparable to the one used in this study. Author (TAB)

N70-38225* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPLE BELLEVILLE SPRING ASSEMBLY Patent
William F. MacGlashan, Jr., inventor (to NASA) Issued 31 Mar. 1964 (Filed 29 Mar. 1963) 4 p Cl. 267-1 Sponsored by NASA
(NASA-Case-XNP-00840; US-Patent-3,127,157; US-Patent-Appl-SN-269222) Avail: US Patent Office CSCL 13I

A spring assembly is described in which the forces are essentially evenly distributed between a plurality of Belleville springs so that each spring carries only its share of the load. Annular outer and inner retainers are divided into complementary segments for radial movement and have parallel grooves to receive the spring peripheries. A sleeve surrounds the outer retainer to secure its segments against radial separation, and a central pin insertable in the inner retainer secures its segments against radial contraction. Attention is paid to facility of assembly and disassembly. The assembly is such that one or more springs may be added or removed to alter the spring force. P.A.B.

N70-38229# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
DEVELOPMENT OF FLIGHT LINE TOOL BOX FOR USE AT A/AEE, JULY-DECEMBER 1968
N. Spratt 21 Jul. 1969 16 p
(AD-706650; AAEE/NOTE/9001) Avail: CFSTI CSCL 13/4

The report describes the development of a machine used to manufacture tool trays from polystyrene sheet using a temperature/vacuum forming technique. The trays moulded to suit tools selected by individual tradesmen as being needed for 1st line servicing of aircraft, enable tradesmen to check quickly that all their tools have been removed from the aircraft on completion of their work. Author (TAB)

N70-38346# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE MEASUREMENT TECHNIQUE FOR DETERMINING FINE DUSTS AND THEIR SEPARATION IN SPRAY WASHERS [UEBER DIE MESSTECHNISCHE BESTIMMUNG VON FEINSTSTAEUBEN UND DEREN ABSCHEIDUNG IN SPRUEHWAESCHERN]
Peter Eisen (Ph.D. Thesis) 1969 111 p refs In GERMAN
(Diss-4228) Avail: CFSTI

Particle measurement techniques and evaluation of various separation system effects were used to determine deposition characteristics of spray washers. An aerosol generator produced particulate matter with grain sizes of 0.1 to 3.0 microns through spray drying of suspensions or solutions containing either polystyrol-latex or salt particles of reproductable grain size and concentration characteristics. Aerosol sizes and concentrations were determined by scattered light particle counters; obtained particle size spectra were compared against electrostatic deposited and microscopic evaluated samples. Performance efficiency of spray washers depended on the contact energy transfer in its compressed air nozzle; inclusion of a fiber glass gasket into the wash channel increased deposition of latex particles with a grain size of 0.3 to 0.4 microns to 91% for corresponding sodium chloride particles to 98%. Transl. by G.G.

N70-38479# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DETERMINATION OF TOOLED DIMENSIONS WITH RESPECT TO MUTUALLY INTERCHANGEABLE ADJUSTMENT AND THE VALUE OF THE PERMISSIBLE MEASURED WEAR OF A TOOL

V. T. Dudnikov et al 27 Jan. 1970 14 p refs Transl. into ENGLISH from Tr. Aviatsionnyi Inst. (Kuibyshev), no. 27, 1967 p 173-179

(AD-706193; FTD-MT-24-334-69) Avail: CFSTI CSCL 13/9

A new practical method is proposed for determining the tooled dimensions in the mutually interchangeable adjustment of metal-cutting machines, as it would apply in evaluating the permissible measured wear of a tool. This method involves machining specially prepared parts (blanks) using two sets of critical characteristics: (1) with minimum allowances (tolerances) and minimum hardness (temporary resistance), and (2) the largest critical characteristics. Authors mention that a number of original errors are not taken into account using this method, and they include: geometric errors in the equipment, random assembling errors at the installation and in fastening components, measuring errors and temperature deformations of parts, tools and equipment. Author (TAB)

N70-38488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ABSORPTION OF ETHYLENE OXIDE AND VINYL CHLORIDE ON AN IRON (011) SURFACE AND EFFECT OF THESE FILMS ON ADHESION

Donald H. Buckley Washington Sept. 1970 17 p refs

(NASA-TN-D-5999; E-5724) Avail: CFSTI CSCL 13H

The influence of chlorine and oxygen in the ethylene molecule on adsorption to iron and the effect of these films on adhesion was studied with low energy electron diffraction and Auger analysis. The displacement of these films from an iron surface by oxygen was also examined. Results indicate that the the presence of chlorine or oxygen in the ethylene molecule reduces the adhesion of iron to itself. Greater amounts of oxygen were necessary to displace vinyl chloride and ethylene oxide from iron surface than was needed to displace ethylene. Ethylene oxide formed a close packed structure whereas a (9 × 2) structure on the (011) surface of iron was observed with vinyl chloride. Author

N70-38511# Sandia Corp., Albuquerque, N.Mex. Advanced Development Div.

ROLAMITE: GEOMETRY AND FORCE ANALYSIS

Richard V. Cadman Apr. 1970 293 p refs

(SC-RR-68-223) Avail: CFSTI

The rolamite is a precision roller-band mechanism whose geometry may be tight, slightly loose, or very loose. The rolamite band may be made to generate forces if its flexural rigidity is varied, or if it is precurved. An analysis of the rolamite geometry is presented. The various clearances, total band length, and the position in the rolamite geometry of any band feature (e.g. cutout) can all be predicted in terms of band tension and other design parameters. The digital computer codes for this analysis are presented, and characteristics of typical rolamite geometries are plotted. The rolamite geometry analysis is shown to be the most powerful tool available for the determination of the band-generated force. Two more direct but less powerful techniques are presented, and results of the three methods are compared to experimentally determined force traces. Band-generated forces are discussed in detail. A dynamic analysis of the rolamite is included, with emphasis on inertial sensing applications. Author

N70-38550*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL LOAD CAPACITY AND POWER LOSS OF HERRINGBONE GROOVED GAS LUBRICATED JOURNAL BEARINGS

Robert E. Cunningham, David P. Fleming, and William J. Anderson May 1970 19 p refs Presented at the ASME 1970 Spring Lubrication Symp., Detroit, 25-27 May 1970

(NASA-TM-X-52753) Avail: CFSTI CSCL 13I

Load capacity, attitude angle, and power loss were determined for 1 1/2 inch diameter herringbone grooved journal bearings operating in air to speeds of 60,000 rpm. Results showed that groove-to-ridge-clearance ratios of 2.0 to 2.4 give a greater load capacity than do ratios outside this optimum range. Agreement with a small-eccentricity pressure perturbation theory was good for groove-to-ridge-clearance ratios in the optimum range. Power loss, relative to that calculated for a plain bearing of the same dimensions, did not vary widely for the range of geometric variables used. Relative power loss increased with speed and was generally higher than for a plain bearing. Author

N70-38601* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DESPIN WEIGHT RELEASE Patent

Otis J. Parker, inventor (to NASA) Issued 14 Apr. 1964 (Filed 31 Jul. 1962) 6 p Cl. 188-1

(NASA-Case-XLA-00679; US-Patent-3,128,845; US-Patent-Appl-SN-213836) Avail: US Patent Office CSCL 13E

A lightweight release mechanism, for use with the Yo-Yo method of despin, to release weights and cables at various positions with respect to the spinning body is described. The assembly includes a latch body, fixed to the spinning mass, with a section removed to form an opening or escapement. The latch bolt is cut away in one section, so that it is too large to pass through the opening until the cut away section is opposite the opening. The angular position of the bolt with respect to the latch body is predetermined. In operation, the weights and cables are initially loosened and move away from the space body. Momentum is transferred from the spinning mass to them, and they in turn rotate the bolt to the desired position. The bolt slips through the opening, thus releasing the weights and cables. N.E.N.

N70-38603* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PRESSURE REGULATING SYSTEM Patent

Orville F. Keller and Willian F. MacGlashan, Jr., inventors (to NASA) Issued 1 Oct. 1963 (Filed 7 Mar. 1962) 5 p Cl. 137-495 Sponsored by NASA

(NASA-Case-XNP-00450; US-Patent-3,105,515; (US-Patent-Appl-SN-180394) Avail: US Patent Office CSCL 13G

A regulator valve and control valve are arranged so as to co-act in the following manner: Initially, the high pressure fluid is applied to the regulator valve in such a way that the valve remains closed until needed and then is explosively opened, or otherwise opened under remote command, to maintain a constant downstream pressure. In its initial closed position, any leakage of pressure fluid into the regulator valve is bled from it rather than being introduced into its downstream side. The valve and valve seat elements may be readily removed from service, and the effective port areas may be changed to alter the regulator valve operating characteristics. Operation of the regulator valve is damped to prevent pressure surges in the system and to prevent valve vibration or squeeling. The system is such that it may remain inactivated for long periods of time and then be brought into operation by sudden release of the pressure source without the production of pressure surges damaging to the component parts. P.A.B.

N70-38605# Bureau of Mines, Pittsburgh, Pa. Energy Research Center.

CONVERSION OF MUNICIPAL AND INDUSTRIAL REFUSE INTO USEFUL MATERIALS BY PYROLYSIS

William S. Sanner, C. Ortuglio, J. G. Walters, and D. E. Wolfson

Aug. 1970 17 p refs
(BM-RI-7428) Avail: CFSTI

Destructive distillation techniques developed to determine the yield and quality of the products from coal were used to convert household and industrial refuse into potentially useful solids, liquids, and gases without adding to environmental pollution. The tests demonstrate that a ton of municipal refuse can be converted into 154 to 424 pounds of solid residue, 0.5 to 6 gallons of tar, 1 to 4 gallons of light oil, 97 to 133 gallons of liquor, 16 to 32 pounds of ammonium sulfate, and 7,380 to 18,058 cubic feet of gas. A ton of industrial refuse, consisting of paper, rags, and cardboard, can be converted to 618 to 838 pounds of residue, 1.5 to 3 gallons of light oil, 68 to 75 gallons of liquor, 12 to 23 pounds of ammonium sulfate, and 9,270 to 14,065 cubic feet of gas. The energy from the gas is more than sufficient to provide the heat for the pyrolysis. Author

N70-38610# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS IN THE THEORY AND SCHEMATICS OF GEAR-LEVER MECHANISMS USED FOR CHIP BREAKING BY A METHOD OF PERIODIC CUTTING
A. S. Shashkin 4 Feb. 1970 17 p refs Transl. into ENGLISH from the Russian
(AD-706652; FTD-HT-23-108-70) Avail: CFSTI CSCL 13/8

A chip breaking device is proposed which consists of 3 basic elements: gear lever mechanisms; excentricity changing mechanism; and excentricity measuring mechanism. This device is to be used with nonhydraulic machine tools. TAB

N70-38620* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SLIT REGULATED GAS JOURNAL BEARING Patent
John H. Laub and Frank F. Batsch, inventors (to NASA) Issued 12 May 1964 (Filed 18 Sep. 1961) 5 p Cl. 308-9 Sponsored by NASA
(NASA-Case-XNP-00476; US-Patent-3,132,903; US-Patent-Appl-SN-182698) Avail: US Patent Office

The slit regulated gas journal bearing described has the following advantages: it reduces turbine torque and the effect of foreign matter in the gas, has a superior stiffness factor and low gas consumption, and is less costly to manufacture. Drawings are included with detailed specifications of the bearing. E.M.C.

N70-38719# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF SYNTHESIS, INVESTIGATION AND USE OF OIL ADDITIVES; FUELS AND POLYMER MATERIALS: SELECTED ARTICLES
A. M. Kuliev et al 12 Mar. 1970 39 p refs Transl. into ENGLISH from Russian Report
(AD-706204; FTD-MT-24-459-69) Avail: CFSTI CSCL 11/8

Contents: Investigation of motor properties of antioxidant additive INKhP-21; Increases in the performance of Ch-10.5/13 series engines by selection of oil additives; Selection of additives to oils for transmissions of ZIL motor vehicles; and The problem of determination of detergent potential of oils with additives. TAB

N70-38720# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICOCHEMICAL CONDITIONS OF DEPOSITING METALLIC AND CARBIDE COATING
N. N. Repnikov et al 20 May 1970 12 p refs Transl. into ENGLISH from Temperaturoustoichivye Zashchitn. Pokrytiya 3d Seminara po Zharostoikim Pokrytiyam Tr. (Leningrad), 1968 p 46-50
(AD-707184; FTD-MT-24-75-70) Avail: CFSTI CSCL 13/8

The report gives the results of studies on the formation of a protective coating from niobium and its carbide by deposition from niobium pentachloride vapor in a current of hydrogen and methane. Author (TAB)

N70-38811 National Lending Library for Science and Technology, Boston Spa (England).
CARBON DIOXIDE TREATMENT
E. Rodet et al 2 Apr. 1970 10 p refs Transl. into ENGLISH from Energie Nucl. (Paris), v. 11, no. 4, Jun. 1969 p 243-245
(NLL-CE-Trans-5301-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The measures used for inhibiting graphite corrosion are described. Methane was used as an inhibiter and a purification plant was installed to remove the decomposition products of the methane (carbon monoxide, hydrogen and water). Author

N70-38813# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPRAISING THE RELIABILITY OF A FINITE AUTOMATION, CONSIDERING ALTERNATING FAILURES
G. A. Volovnik 5 Mar. 1970 15 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (USSR), no. 1, 1968 p 44-49
(AD-706203; FTD-MT-24-451-69) Avail: CFSTI CSCL 14/4

A Markovian model has been built and a reliability function of a finite automaton has been obtained to the input of which a random sequence of input signals proceeds. The model reflects the connection of the process of functioning of a finite automaton with the process of structural changes which are caused by possible disturbances. Along with stable disturbances, the disturbances which bear an alternating character are considered. Author (TAB)

N70-38830# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DUST COLLECTING
V. N. Uzhov 11 Mar. 1970 21 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchest. Im. D. I. Mendeleeva (USSR), v. 14, no. 4 1969 p 432-437
(AD-706206; FTD-MT-24-28-70) Avail: CFSTI CSCL 13/8

The article deals with the industrial purification of gases in order to decrease contamination of the air, to collect valuable products from gases, and to remove harmful impurities from them. A brief review is presented of the nature and size of particles to be removed from the gases and the determination of efficiency of dust-catching devices. In the discussion dust catchers are broken down in the following groups: (1) dry or mechanical dust catchers; (2) wet dust catchers; (3) filters; (4) electro-filters. The article ends with a brief note concerning the effectiveness of combined units. The article contains a table showing the technical and economic indices of the most prevalent models of dust catchers. Author (TAB)

N70-38869# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.
VAPOR-JET VACUUM PUMPS: SELECTED CHAPTERS
A. B. Tseitlin 3 Apr. 1970 120 p Transl. into ENGLISH from the Book "Parostryunyye Vakuumnyye Nasosy" Moscow, Izd-Vo Energiya, 1965 p 85-196
(AD-707182; FTD-MT-24-23-70) Avail: CFSTI CSCL 13/11

The book contains generalized and systematized data on the development, investigations of operation of steam-jet vacuum pumps. Given are contemporary concepts on the operating mechanism of pumps and the latest achievements in the field of pump design. Special attention was given to the description of various physical phenomena taking place in pumps, characteristics of their operation, calculation and design of pumps. TAB

N70-38960# Du Pont de Nemours (E. I.) and Co., Buffalo, N.Y.
SIMULATION OF HEAT SEALING POLYMER COATED CELLOPHANE ON AN OVERWRAPPING MACHINE
A. V. Levy and V. C. Haskell [1969] 19 p refs Presented at Southeastern Reg. ACS Meeting, Richmond, 5-8 Nov. 1969
Avail: CFSTI

A related study showed the variation of temperature versus time and depth in the sheet for polypropylene film, and pointed out the advantage of using an insulated surface opposite the hot sealing bar and the necessity to avoid trapped air layers between films. In the present study, the package itself acts as the backing surface and pressure is of necessity low and is poorly controlled. The heat capacity of cellophane as a function of temperature from 0 to 200 C was determined as well as the temperature distribution at two fixed pressures as a function of time in a stack of cellophane sheets corresponding to the folded layers at the end of a carton. The results were fitted in a computer model. The heat seal strength of the film was determined as a function of interface temperature. These heat seal data were combined with temperature distribution data and the effective temperature range was predicted within which a packaging machine must operate at fixed sealing pressure and machine speed to obtain a satisfactory seal in every layer of the overwrap. Author

N70-38979 National Lending Library for Science and Technology, Boston Spa (England).
SPINNING OF FIBRES FROM POLYMER MELTS WITHOUT USING JETS
K. E. Perepelkin et al 24 Jun. 1970 7 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 1, 1970 p 11-13 (NLL-M-9186-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Thread drawing through the orifices of diaphragm covered polymer melts is used to manufacture synthetic fibers from polypropylene and atactic polystyrene. Microscopic examination of bicomponent fiber cross sections shows that skin and core are circular and that the core is located along the fiber axis. Stability of bicomponent fiber spinning depends on the distance between needle and diaphragm, needle diameter, solidification temperature, and feed rate of the injected component. G.G.

N70-38998* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EJECTION UNIT Patent
William F. Mac Glashan, Jr., inventor (to NASA) Issued 23 Feb. 1965 (Filed 26 Jun. 1963) 5 p Cl. 222-389 Sponsored by NASA
(NASA-Case-XNP-00676; US-Patent-3,170,605; US-Patent-Appl-SN-290870) Avail: US Patent Office CSCL 13K

An ejection unit is described that is adapted to deliver a precise quantity of oxidizer or other propellant component into a combustion chamber or catalyst bed to initiate a reaction in a rocket motor, so that the operation may be repeated at will by remote or automatic command. The ejection valve is operated by a special pressure fluid or by pressure exerted by another of the propellant fluids and provides attitude control and midcourse guidance of space vehicles. R.B.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-37602# California Univ., Berkeley. Lawrence Radiation Lab.
THE TEM SUB 00 MODE IN A MODE-LOCKED NEODYMIUM-GLASS LASER
Robert A. Fisher Jan. 1970 8 p refs
(Contract W-7405-eng-48)
(UCRL-19147) Avail: CFSTI

A successful technique is described for spatial control of the transverse modes in a mode-locked Neodymium-glass laser. The technique utilizes spatial aperturing (within the cavity) in conjunction with split-image near-field photography through the 99% reflecting mirror. Author

N70-37657# Sandia Corp., Albuquerque, N.Mex.
HOLOGRAPHIC INSPECTION OF THE DEFORMATION PATTERNS OF CARBON-CARBON CYLINDERS UNDER LOAD
O'Neill J. Burchett and John L. Irwin Apr. 1970 43 p refs Sponsored by AEC
(SC-DR-69-281) Avail: CFSTI

An investigation to determine the feasibility of using laser holography for nondestructive testing of carbon-carbon shapes was made. Carbon composite thin wall cylinders were loaded in hoop tension by a 50-psig internal pressure, and holograms were made of the deformation patterns. These cylinders were then tested to destruction. A procedure was developed to reduce the fringe patterns on the holograms to radial deformation and to surface strain for cylinders and cones. The procedure was applied to two types of cylinders. The first type was tested by internal pressure and the second was axially loaded on its closed end. The two cylinders failed in areas of strain anomalies as predicted by the nondestructive holography method. A distinct change in strain resulted in the area that fracture occurred. Author

N70-37763# General Electric Co., Philadelphia, Pa. Missiles and Space Div.
DESIGN RESEARCH OF LOW ANGULAR-DEGRADATION RETROREFLECTORS Final Report, 15 Feb. 1966 - 28 Nov. 1969
Gerald Hieser 19 Jan. 1970 83 p refs
(Contract AF 19(628)-5841)
(AD-707121; AFCRL-70-0063; Doc-70SD4201) Avail: CFSTI CSCL 20/6

Included in this report is a description of the work performed on the development of both solid and hollow cube corner reflectors. The objectives were to develop cube corners that are diffraction limited in the visible spectrum and shall remain diffraction limited at all temperatures in the expected lunar environmental temperature range. Author (TAB)

N70-37879 California Univ., Berkeley.
RADIATION TRAPPING PROCESSES IN THE PULSED ION LASER
Marvin Bertrand Klein (Ph.D. Thesis) 1969 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-18944

It was recognized that the trapping of ion resonance radiation may be responsible for the degraded performance of the pulsed ion laser at moderate and high pressures. It is shown from a rate equation approach that the trapping is most severe at small values of the ion Doppler width and at high electron densities. Several experiments intended to determine the functional dependence of the lower laser level population, the laser gain and the ion Doppler width are reported. The results of the experiments are in good agreement with the theoretically predicted behavior. Dissert. Abstr.

N70-37894# Sylvania Electronic Systems-West, Mountain View, Calif. Electro-Optics Organization
PARAMETRIC OSCILLATOR RESEARCH Annual Report, 15 May 1969 - 15 May 1970

E. O. Ammann, G. A. Massey, and J. M. Yarborough 15 May 1970 44 p refs
(Contract N00014-69-C-0296)
(AD-707424) Avail: CFSTI CSCL 20/5

The objective of the research was to investigate techniques for extending the tuning range of optical parametric oscillators further into (a) the infrared and (b) the visible and ultraviolet. Two separate tasks are discussed. The first is an experimental and theoretical study of a proustite oscillator which is pumped by the 1.06 micron output of a Nd:YAG laser, and the second a study of an ammonium dihydrogen phosphate (ADP) oscillator which is pumped by the frequency-quadrupled output from a Nd:YAG laser. The report summarizes the results of work on these tasks. A proustite optical parametric oscillator has been designed, built, and successfully operated. The oscillator operates near degeneracy with signal and idler outputs near 2.13 microns. Also completed was the design of an oscillator which is pumped by the fourth harmonic of the 1.06 micron output from a Nd:YAG laser. ADP has been selected as the nonlinear material, and an optimum crystal orientation established. Calculations have been carried out on temperature-tuning of the oscillator, and of the pump power required to reach threshold. A unique oscillator resonator design has been devised which will eliminate the need for coatings which can withstand the substantial ultraviolet pump power densities involved.
Author (TAB)

N70-37944# Fort Detrick, Frederick, Md.
POLARIZATION OF LASER RADIATION SCATTERED BY FOG AND SMOKE
M. V. Kabanov et al 25 May 1970 10 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Fiz. Atmosfery i Okeana (USSR), v. 4, no. 10, 1968 p 1116–1119
(AD-706566; Trans-2718) Avail: CFSTI CSCL 4/1

Questions of atmospheric optics, the visibility of polarized radiation sources in the atmosphere, light conditions in the depth of the scattering medium illuminated by polarized radiation, and other matters are linked with the need to investigate the polarization characteristics of scattered light. The use of lasers with linear radiation polarization substantially increases the range of conditions in which the polarization characteristics of scattered light may be investigated. Experimental investigations of the degree of polarization of forward scattered and backward scattered (reflected) light during radiation discharge in artificial fog and smoke are given.
Author (TAB)

N70-37965# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF PLASMA PROPERTIES OF HIGH ENERGY GAS DISCHARGE LASERS Annual Summary Report, 1 Apr. 1969 – 30 Apr. 1970
William L. Nighan, Walter J. Wiegand, Michael C. Fowler, and Robert H. Bullis 30 Apr. 1970 58 p refs
(Contract N00014-69-C-0309)
(AD-706773; UACRL-J920833-3) Avail: CFSTI CSCL 20/5

The report is directed toward determining the important plasma properties and collisional interactions governing the conversion of electrical energy to optical energy in high power CO2 electric discharge lasers. Toward this end, extensive analytic studies have been made which couple the effects of electron and molecule collision processes with plasma properties in a comprehensive model, resulting in identification and evaluation of those factors which determine CO2 electric discharge laser performance. In addition, precise measurements of plasma properties have been made in CO2 laser discharges and the experimental results correlated with those of the analytical portion of the program. The results of these studies provide improved insight and understanding of those factors which most influence laser operation, and suggest means whereby the performance of high energy laser systems can be improved.
Author (TAB)

N70-37974# Atomospheric Sciences Office, White Sands Missile Range, N.Mex.
THE ERBIUM DOPED GLASS LASER-PERFORMANCE AND ATMOSPHERIC PROPAGATION CHARACTERISTICS
K. O. White, E. H. Holt, and R. F. Woodcock Mar. 1970 27 p refs
(AD-706220; ECOM-5294) Avail: CFSTI CSCL 20/5

The technological status of the erbium laser is described. When a glass base is used, this laser emits energy in the neighborhood of 1.54 micrometers, which is in the so-called eye-safe region of the spectrum. It has been found that a close-coupled arrangement of the laser rod and a linear flash lamp gives the lowest pump threshold energy. The emission characteristics of the erbium laser which uses a phosphate glass base have been determined. Factors affecting the transmission of energy of this wavelength in the atmosphere are discussed.
Author (TAB)

N70-38061# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
LASER EMISSION FROM METAL-SEMICONDUCTOR BARRIERS ON PbTe AND Pb(0.8) Sn(0.2) Te
James N. Walpole, Kenneth W. Nill, Arthur R. Calawa, and Theodore C. Harman Apr. 1970 17 p refs Submitted for publication Sponsored in part by AF Prepared in cooperation with Lincoln Lab.
(Contract N00014-67-A-0204-0010)
(AD-706308; TR-4) Avail: CFSTI CSCL 20/5

Laser emission is obtained from forward biased evaporated metal barriers on degenerate p-PbTe and p-Pb(0.8)Sn(0.2)Te at T = 4.2 degrees K. Metals with small work functions such as In, Pb, and Zn produce a degenerate inverted n-type surface region on p-type samples without chemical doping. Low threshold laser emission has been obtained from these barriers on p-PbTe at a wavelength of 6.4 micrometers and from Pb barriers on p-Pb(0.8)Sn(0.2)Te at a wavelength of 15 micrometers.
Author (TAB)

N70-38075# Hughes Research Labs., Malibu, Calif.
DAMAGE THRESHOLD STUDIES IN LASER CRYSTALS Semiannual Report, 21 May – 21 Dec. 1969
Concetto R. Giuliano, Robert W. Hellwarth, La Verne D. Hess, and Gerald D. Rickel Jan. 1970 37 p refs
(Contract F19628-69-C-0277; ARPA Order 1434)
(AD-706414; AFCRL-70-0178; SAR-1) Avail: CFSTI CSCL 20/5

In the report a mode-controlled giant pulse laser oscillator and amplifier are described. The oscillator employs a temperature-controlled resonant reflector, a dye Q-switch laser and a 2 mm aperture to assure single mode operation. The result of preliminary threshold measurements on a few different ruby samples are presented. Equations which describe the propagation of the gaussian mode are examined in order to answer some important questions concerning focusing inside dielectric media. The potential usefulness of the scanning electron microscope as a tool for examining surface damage is pointed out by the presentation of a few interesting photomicrographs. The theoretical effort is concentrated on the effects of strong optical fields on relatively low densities of electrons in the conduction band of a transparent polar crystal. The present studies have led to agreement with the general opinion that these electrons are a key link in the optical pulse damage process.
Author (TAB)

N70-38099# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COMPARISON OF HF AND DF CONTINUOUS CHEMICAL LASERS
Donald J. Spencer, Harold Mirels, and Theodore A. Jacobs 1 Mar 1970 13 p refs
(Contract F04701-69-C-0066)
(AD-707519; TR-0066(5756-01)-3; SAMSO-TR-70-198) Avail CFSTI CSCL 20/5

A continuous DF chemical laser radiating at approximately 4 microns is reported. Population inversion is obtained by diffusing D2 into a supersonic free jet containing F atoms. The performance of the DF laser is compared with a similar HF laser previously reported. The ratio of DF to HF laser output power is 0.7 for fixed supersonic jet conditions and the same molar flow of H2 and D2. The efficiency of conversion of chemical energy to laser energy is approximately 12% and 8% for the HF and DF lasers, respectively. Author (TAB)

N70-38128# Toronto Univ. (Ontario). Inst. for Aerospace Research.

LASER EXCITATION AND DIAGNOSTICS

In its [Inst. for Aerospace Res.] Nov. 1969 p 106-112 (See N70-38116 21-01)

Avail: CFSTI

The work at UTIAS in exploring the potential applications of laser excitation and diagnostics is reported. The principle of radiatively coupling the populations associated with the two levels of an atomic transition is used in the theory of electron density and temperature enhancement by laser resonance pumping. This technique is considered to be of significance in the field of MHD power generation for it might lead to effective form of preionization. Experimental evaluation of this theory is being undertaken and the relevant apparatus is now under construction. An extension of the two frequency interferometric technique used to measure the variation of electron density behind a shock front was studied. This extension uses the anomalously high value of the refractive index presented to radiation with a frequency close to that of an absorption line within a gas or plasma. Author

N70-38145*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE GRAVITATIONAL RED SHIFT

Peter Eby 16 Sep. 1969 18 p refs

(NASA-TM-X-53914; MSFC-IN-SSL-N-68-19) Avail: CFSTI CSCL 20E

The general relativistic red shift effect and its proposed measurement by means of the Hydrogen Maser Clock is discussed. Some aspects of the problem are considered which are not referred to in the standard texts on relativity. In particular, the effect of the gravitational field on the physical mechanism of the atomic clock is discussed. Author

N70-38151# Wesleyan Univ., Middletown, Conn. Dept. of Physics.

A LASER-INTERFEROMETER SYSTEM FOR THE ABSOLUTE DETERMINATION OF THE ACCELERATION OF GRAVITY Final Report, 1 Jul. 1967 -31 Dec. 1969

James E. Faller and James A. Hammond Mar. 1970 156 p refs

(Contract F19628-67-C-0376)

(AD-707522; AFCRL-70-0163) Avail: CFSTI CSCL 20/6

A new and portable instrument for making an absolute determination of the acceleration of gravity has been built. The design and construction of this apparatus together with the results obtained using it are discussed. The instrument consists of an optical interferometer in which one of the mirrors, a corner cube reflector, freely falls. The resulting fringes are counted to provide a direct measurement of the distance fallen in terms of the wavelength of light. A stabilized He-Ne laser is used for the light source and provides the required coherence and brightness to achieve high quality fringes over the one meter dropping distance. The drop-to-drop scatter is less than 1 part in 10,000,000, and the consistency of 50 drop data sets each is better than plus or minus 3 parts in 10 to the 8th power. Non-gravity forces and other experimental factors have been carefully taken into account; the accuracy of the final results (70% confidence level) is plus or minus 5 parts in 10 to the 8th power. Author (TAB)

N70-38186# Massachusetts Inst. of Tech., Cambridge.

APPLICATION OF GAS LASERS TO STUDIES OF FUNDAMENTAL MOLECULAR AND ATOMIC PROCESSES Annual Technical Report, 1 Jan. -31 Dec. 1969

Ali Javan 10 Apr. 1970 69 p refs

(Contract N00014-67-A-0204-0014; ARPA Order 306)

(AD-706349; TR-2) Avail: CFSTI CSCL 20/5

The report covers laser and quantum electronics research in several areas. A bi-stable optical element has been developed which can produce short pulses of variable length and intensity. A standing-wave saturation technique has been applied to the measurement of rotational relaxation linewidths in CO2. Molecular relaxation processes are being studied using coherent optical processes. An experimental and theoretical study of short pulse propagation in SF6 has been completed. Considerations are also given relating to propagation of zero-degree pulses. Plans are under way to study relaxation processes in the CO laser. Author (TAB)

N70-38195# Aerospace Corp., El Segundo, Calif. Lab. Operations.

INITIAL PERFORMANCE OF A CW CHEMICAL LASER

Donald J. Spencer, Harold Mirels, and Theodore A. Jacobs 1 Mar. 1970 26 p refs

(Contract F04701-69-C-0066)

(AD-707518; TR-0066(5756-01)-2; SAMSO-TR-70-197) Avail: CFSTI CSCL 20/5

Performance of a continuous HF chemical laser is presented. Population inversion was obtained by diffusion of H2 into a supersonic jet containing F atoms. A peak power of 630 w was obtained with an F atom flow rate of 0.040 mole/sec. The conversion efficiency of chemical energy to laser energy was 12%. Performance of a corresponding DF laser is also given. Major laser output is from 2-1 and 1-0 transitions for both lasers. Radiation is at 2.6 to 2.9 microns and 3.6 to 4.0 microns for the HF and DF lasers, respectively. The ratio of DF to HF laser power is 0.7 under similar flow conditions. Author (TAB)

N70-38312# Eidgenossische Technische Hochschule, Zurich (Switzerland).

DEFECTS AND COLOR CENTERS IN VERNEUIL RUBY LASERS [DEFEKTE UND FARBZENTREN IN VERNEUIL-LASERRUBINEN]

Werner Johann Borer (Ph.D. Thesis) 1969 97 p refs In GERMAN

(Diss-4301) Avail: CFSTI

Investigated are defects, color centers, and reduction-oxydation mechanics found in synthetic single crystal ruby lasers. Spectroscopic and analytic evaluations of defect ruby laser color centers attributed an ultraviolet absorption band at 315 mm to the presence of chromium (+3) at intersecting lattice spaces. Thermal treatment at 1550 C for about two days lowered the threshold for stimulated emission and thus increased the output power of the ruby laser. Transl. by G.G.

N70-38525# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.

GAS LASER RESEARCH IN THE INFRARED AND VISIBLE RANGE Final Report, 1 Feb. 1968 - 31 Dec. 1969

Ali Javan 3 Jan. 1970 237 p refs

(Contract F19628-68-C-0204)

(AD-706404; AFCRL-70-0147) Avail: CFSTI CSCL 20/5

The report covers laser and quantum electronics research in the areas of precision length and frequency measurements using laser harmonic frequency mixing, laser-induced line narrowing effects and their applications, self-induced transparency and related phenomena, and molecular relaxation measurements. Work in the area of laser harmonic frequency mixing includes observation of beat notes between adjacent 10.6 micron CO2 laser transitions at 54GHz, absolute frequency measurements of the 84 micron D2O laser transition, infrared mixing of the 28 micron water vapor laser

with the 9.3 micron CO2 laser, and high-accuracy length measurements of far infrared laser transitions. In the area of laser-induced line narrowing, a detailed theory has been developed which describes effects such as mode crossing and spontaneous emission line narrowing. As an example of the application of this theory, the level crossing effect in stimulated emission has been used to obtain a precise determination of hyperfine structure in an excited electronic state of Xe129. In the area of molecular relaxation measurements a detailed study of the decay mode of excited CO2 through pure CO2 has been completed. The diffusion constant, collision cross sections and wall de-excitation probabilities have been obtained. Author (TAB)

N70-38526# Florence Univ. (Italy). Istituto di Onde Elettromagnetiche.
THEORETICAL AND EXPERIMENTAL STUDY OF UNSTABLE LASER RESONATORS. RIMMED RESONATORS Final Report, 15 Apr. 1968 - 30 Sep. 1969
P. F. Checcacci, A. Consortini, and A. M. Scheggi 31 Dec. 1969 43 p refs
(Contract F61052-68-C-0052)
(AD-707132; AFCRL-70-0287) Avail: CFSTI CSCL 20/5

The report is concerned with the theoretical and experimental research on open resonators terminated by plane mirrors with a rim along the edges. The effect of two different rim shape is investigated. The first part of the report is concerned with the treatment of the problem of modes and losses of the step and sloped rim mirror resonators. The second part is concerned with the description of the experiments perfomed by means of mocrowave models of such resonators as well as with an application of such kind of resonator to the construction of band pass filters. Author (TAB)

N70-38552*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
ATMOSPHERIC AND OCEANOGRAPHIC SUPPORT STUDIES FOR LASER RADAR EXPERIMENT ABOARD THE ADVANCE 2 DURING BOMEX
Walter D. Bach, Jr. and James R. Smith Aug. 1970 32 p refs
(Contract NAS1-9161)
(NASA-CR-66978) Avail: CFSTI CSCL 20E

Laser firings were made to investigate the features of the marine atmosphere and to evalute the performance of the laser within a marine environment. Frequent radiosonde releases were made to provide data on the thermal and moisture structure of the atmosphere. Analyses of both high altitude (>15 km) and low altitude (> 3 km) laser data were made for one of the observing stations. The presence of dust layers between 15 and 25 km was verified. Short term changes in dust concentrations and the laser profile characteristics were noted. Data obtained by varying the elevation angle of the laser and firing at approximately one-minute intervals permitted the construction of space cross sections through the planetary boundary layer. The resulting distributions show characteristics of a dry convective regime having the dimensions and other properties of fair weather cumulus clouds. Estimates of vertical velocities in the clouds were made. The intertropical convergence zone was located by an air trajectory analysis. Measurements of particle number density to the south of that zone showed an order to magnitude decrease in large (>1micron) particles from measured number densities to the north of the zone. Author

N70-38641# TRW Systems Group, Redondo Beach, Calif. Quantum Physics Lab.
INFRARED TO VISIBLE IMAGE CONVERSION TECHNIQUES Final Report
S. A. Pollack Apr. 1970 78 p refs
(Contract N00014-68-C-0397)
(AD-707050; TRW-11054-6006-R0-00) Avail: CFSTI CSCL 20/5

The report covers a two year program to perform feasibility study of constructing a solid state device capable of converting an infrared image produced by 10.6 micron CO2 laser radiation into a visible image. Three approaches were investigated based on (1) quantum counter principle, (2) selective thermal radiation and (3) thermographic detection using hydrated crystals. The major difficulty encountered in the course of the investigation of the quantum counter principle was in matching the signal frequency to the separation of the energy levels involved in the scheme. Very encouraging results were obtained from measurements of the transition probabilities determining potential quantum efficiency of the device. Application of the selective thermal radiators for the infrared imaging was thoroughly investigated. The obtained results are very useful and promising. Performance of the selective thermal radiators favorably competes and in many respects is superior to performance of the viewing screens made of other materials sensitive to thermal radiation. Thermographic screens made of hydrated salts were tested and their usefulness for imaging of weak infrared radiation was demonstrated. Author (TAB)

N70-38775# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
DESIGN AND OPTIMIZATION OF RUBY LASERS IN THE USSR
Yuri Ksander May 1970 41 p refs
(Contract DAHC15-67-C-0011)
(AD-707315; IDA/HQ-70-11457; N-722(R)) Avail: CFSTI CSCL 20/5

A comprehensive review is made of Soviet Research on ruby lasers as reflected in the open scientific literature for the period from January 1968 through December 1969. It is shown that in the laser power sweepstakes, the Soviets have fielded some of their best researchers at several facilities to optimize the design of optically-pumped solid state devices. Research groups and their specialized areas of interest are identified and, in some instances, the Soviet and Western results are juxtaposed. Author (TAB)

N70-38819# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
DETECTION CONSIDERATIONS FOR LASER SYSTEMS IN THE NEAR INFRARED: PROGNOSIS FOR AN IMPROVED TECHNOLOGY
A. Fenner Milton and Alvin D. Schnitzler Apr. 1970 60 p refs
(Contract DAHC15-67-C-0011)
(AD-707317; IDA/HQ-70-10983; RP-P-581) Avail: CFSTI CSCL 17/5

The paper summarizes the influence of detection considerations on the standard military optically pumped laser systems. The problems and uncertainties associated with the development of new photocathodes for the near infrared are discussed in detail. A variety of laser detection schemes are examined to determine their potential in the 1.5 micron to 2.5 micron region. The problems of imaging systems for use with laser illuminators are discussed. A research program is recommended to improve detector performance. Author (TAB)

N70-38877# Battelle Inst., Frankfurt am Main (West Germany).
THE LASER AND ITS APPLICATION
Karl Guers *In its* Battelle Inform. No. 1 Mar. 1968 p 6 - 19
(See N70-38876 21-34)
Avail: CFSTI

After a short historical introduction, He-Ne, argon, CO2, ruby, neodymium glass, semiconductor, neodymium in yttrium aluminium garnet, and neodymium in selenium oxychloride lasers are briefly described. The use of lasers for plasma diagnostics, holography and in medicine etc. are discussed. ESRO

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-37603# Sandia Corp., Albuquerque, N.Mex.
TEMPERATURE INFLUENCE ON THE SHOCK RESPONSE OF 2024 ALUMINUM
John A. Brammer Mar. 1970 67 p refs
(SC-RR-70-124) Avail: CFSTI

Shock compression experiments reaching peak stresses of 20 kilobars were performed on precipitation-hardened 2024 aluminum at temperatures of 22, 288, and 371 C to investigate the influence of temperature on the alloy's dynamic response. The velocity interferometer technique was used to monitor the free-surface velocity of heated targets subjected to plate impacts with a gas gun. Dynamic compressive stress-strain curves determined from these measurements show decreases in both the hydrostatic and deviatoric components of stress for increases in target temperature. To investigate the feasibility of predicting the measured shock response of 2024 aluminum at elevated temperatures from less complicated experiments and analyses, one-dimensional strain compression curves were constructed from elastic constant and quasi-static uniaxial-stress compression test data using strain-rate independent elastic-plastic theory. When the measured and calculated stress strain curves are compared at each temperature, their elastic slopes and peak compression states conicide within experimental error. Author

N70-37637# California Univ., Berkeley. Lawrence Radiation Lab.
THE EFFECT OF ORDERING ON LATTICE HEAT COPACITIES: ORDERED AND DISORDERED AuCu
Donald Thomson Hawkins (Ph.D. Thesis) Mar. 1970 80 p refs
(Contract W-7405-eng-48)
(UCRL-19125) Avail: CFSTI

Heat capacities of pure gold and AuCu in both the ordered states were measured between 20 and 298 K by isothermal calorimetry. Values for pure gold agree well with previous data except in the temperature range to 70 to 150 K, where they are 0.5 to 1.0% high. Combination of the heat capacity data for AuCu obtained in this study with existing high temperature data yields the configurational entropy of the disordered state: S sub 0, disordered = 1.280(+ - 0.1) e.u. This value is somewhat lower than the theoretical value of 1.38 e.u. expected for this alloy. The difference is attributed to short range order, the existence of which is confirmed by heat of formation measurements. The effect of short range ordering on the Cp values is discussed. Ordered and disordered states both show a slight positive deviation from Kopp's Law up to about 175 K; then the deviations become slightly negative. The heat capacity of the disordered state is higher than that for the ordered state to 100 K, above which it becomes slightly lower. In agreement with previous data on AuCu3 up to 4.2 K, little change of Cp on ordering was observed. Details of the design and operation of the calorimeter are given. Author

N70-37639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE AGING OF PERMANENT MAGNET ALLOYS AT TEMPERATURES OF 550-700 DEG C
L. A. Kavalerova et al 6 Feb. 1970 14 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 12, 1968 p 72-75
(AD-706162; FTD-HT-23-643-69) Avail: CFSTI CSCL 11/6

The influence of structural aging in the range 550 to 700 degrees centigrade of YuNDK35T5 and YuNDK24 (All Union State Standard 9576 60) type alloys on their magnetic properties is examined. For the YuNDK35T5 type alloy, the change in structure as a result of structural aging in the given temperature range over a long period of time (on the order of 1000 hours) is studied. The difference in the change of magnetic induction between alloy types YuNDK35T5 and alloys YuNDK24 and YuNDK25BA is insignificant. In all YuNDK35T5 type alloys, a rapid decrease in magnetic induction begins at temperatures higher than 600 degrees centigrade; in YuNDK24 type alloys at 600 degrees centigrade, magnetic induction continuously falls. Structural transformations at 550 degrees centigrade in all alloys and in YuNDK35T5 type alloys at 600 degrees centigrade may lead to an increase in magnetic induction during repeated magnetization to saturation after holding. However, an increase in induction as a result of general aging of magnets (without repeated magnetization) ordinarily does not exceed 1 percent, even in those cases where repeated magnetization gives an increase in induction greater than 10 percent (pure structural aging). Author (TAB)

N70-37733# California Univ., Berkeley. Lawrence Radiation Lab.
ROLE OF GRAIN BOUNDARIES ON CRACK GROWTH
W. W. Gerberich, V. F. Zackay, E. R. Parker, and D. Porter Sep. 1969 50 p refs Presented at 16th Sagamore Conf. on Ultrafine Grain Metals, Raquette Lake, N.Y., 19-22 Aug. 1969, Sponsored by Army Mater. Res.
(Contract W-7405-eng-48)
(UCRL-19176) Avail: CFSTI

Analysis of two major fracture modes, transgranular cleavage in plain carbon steels and ductile intergranular fracture in an Al-Zn binary alloy, is presented with emphasis on grain-size effects. A theoretical interpretation of the plastic constraint factor, as applied to sharp cracks, leads to a critical stress intensity for unstable cleavage. An experimental technique, which measures the stress waves emitted from discontinuous crack movements, allowed detection of non-propagating cleavage microcracks. For ductile intergranular fracture, the plastic work to nucleate fracture in a grain boundary is considered. Stress-wave demonstrated that the stress intensity to nucleate the first crack decreases with grain size as approximately predicted. Author

N70-37738# Army Materials and Mechanics Research Center, Watertown, Mass. Theoretical and Applied Mechanics Research Lab.
FAILURE ANALYSIS: THEORY AND PRACTICE
Joseph I. Bluhm May 1970 100 p refs Presented at William Hunt Eisenman Conf. on Failure Analysis, New York, 12-14 Jul. 1966; Chicago, 30 Jan.-1 Feb. 1968; Philadelphia, 19-20 Jun. 1968
(AD-707463; AMMRC-MS-70-2) Avail: CFSTI CSCL 11/6

The failure problem is first defined in terms of relative ductility prior to fracture as contrasted to the ductility associated with the fracturing process directly. Subsequently, the effects of temperature and stress state - considered as the two most significant factors in brittle behavior - are discussed in detail particularly in light of their effects on the various modes of fracture. Correlations between specimens and/or specimens and prototypes are associated with the nature of the fracture mode. The significance of notched specimens is shown to stem from the marked influence the notches have on the stress state, tending to produce a hydrostatic tension field. A number of materials evaluation tests are described concentrating principally on notch tension and notch bend specimens but including reference to crack arrest tests. Several concepts are described which provide the designer with procedures for adequate safeguards against failure. Author (TAB)

N70-37745# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBTAINING THIN COPPER-TITANIUM ALLOY FILMS BY VACUUM DEPOSITION
A. N. Pilyankevich et al 1 May 1970 11 p refs Transl.

into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Tekh. Nauk (Armenian SSR), v. 22, no. 1, 1969 p 48–52
(AD-707295; FTD-HT-23-209-70) Avail: CFSTI CSCL 11/6

A method is described for preparing thin films of a given compound by the simulataneous evaporation of the components from 2 sources. The rates of evaporation of Cu and Ti were determined experimentally under conditions of vacuum sputtering, and equations are given which describe the dependence of the rate on temperature. The sputtered films are a metastable solid solution of Ti and Cu formed as the result of quenching the vapor on the substrate. The parameter of the solid solution, a equals 3.623 A., indicates that the concentration of dissolved Ti is close to the value given under the sputtering conditions (5 wt. percent). Author (TAB)

N70-37746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRITICAL POTENTIAL OF THE CORROSION INHIBITION OF MILD STEEL
S. N. Pandei et al 5 May 1970 18 p refs Transl. into ENGLISH from Tr. Mezhdunarodnogo Kongressa Korrozii Metallov, 3rd (USSR), v. 2, 1968 p 195–202
(AD-707298; FTD-MT-24-71-70) Avail: CFSTI CSCL 11/6

The critical potentials (c.p.) for the corrosion inhibition of mild steel in 0.01 M NaCl solns. by the addn. of 0.1 mole/1 of Na benzoate is minus 0.525 v (vs S.C.E.), while the c.p. for the inhibition by NaNO changes from minus 0.555 to minus 0.620 v as the NaNO concn. (in an aerated soln.) is increased from 200 to 1600 ppm. The corrosion rate in deaerated solns. was higher than in aerated solns., and the main corrosion product in aerated and deaerated solns. was gamma-Fe 0 and Fe -, resp. The cathodic polarization curves indicate that in spite of being an anodic inhibitor, the NaNO has a marked effect on the cathodic process, and that the mechanism of the corrosion process involves either 0 depolarization or 0 diffusion; the c.p. corresponds to the point of transition from one mechanism to the other. TAB

N70-37782# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE OPTICAL CONSTANTS OF LIQUID AMALGAMS [DIE OPTISCHEN KONSTANTEN VON FLUESSIGEN AMALGAMEN]
Jakob Guggenhein (Ph.D. Thesis) 1969 refs In GERMAN
(Diss-Nr-4373) Avail: CFSTI

Described is a vacuum apparatus for measuring optical constants of liquid amalgams at room temperatures by analyses of light reflection from their liquid surfaces. A PbS detector is used to determine the boundary wave length in the visible spectrum and a compensator-detector is used to determine the boundary wave length in the visible spectrum and a compensator-detector to analyse the infrared radiation source. Empirical interpretations of dielectric optical constants for Hg and its amalgams are shown in tables; they differ substantially from those determined by the Drude theory. Transl. by G.G.

N70-37858# Joint Publications Research Service, Washington, D.C.
DIFFUSION IN METALS
7 Aug. 1970 18 p refs Transl. into ENGLISH from various Russian publ.
(JPRS-51124) Avail: CFSTI

CONTENTS:

1. RESIDUAL STRESSES RESULTING FROM DIFFUSION IN AN ELASTIC, HOMOGENEOUS PLATE V. S. Pavlina et al p 1–9 refs (See N70-37859 21-17)
2. METHOD OF DETERMINING DIFFUSION FACTOR IN X-RAY STUDIES R. L. Fogelson p 10–16 refs (See N70-37860 21-17)

N70-37859# Joint Publications Research Service, Washington, D.C.
RESIDUAL STRESSES RESULTING FROM DIFFUSION IN AN ELASTIC, HOMOGENEOUS PLATE
V. S. Pavlina et al *In its* Diffusion in Metals 7 Aug. 1970 p 1–9 refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR, (Kiev), v. 4, no. 4, 1968 p 384–389 (See N70-37858 21-17)
Avail: CFSTI

The stressed state, caused by uneven distribution of a diffusing material, is studied. Approximate formulas are produced for the determination of residual stresses under various conditions of diffusion saturation. Author

N70-37860# Joint Publications Research Service, Washington, D.C.
METHOD OF DETERMINING X-RAY STUDIES
R. L. Fogelson *In its* Diffusion in Metals 7 Aug. 1970 p 10–16 refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 25, no. 3, 1968 p 492–496 (See N70-37858 21-17)
Avail: CFSTI

The intensity of the X-ray line of a metal is calculated after diffusion of some component into the metal. The dependence of the intensity of the line of the diffusion factor found in this case can be used for practical determination of the diffusion factors in X-ray studies. Author

N70-37869# Watervliet Arsenal, N.Y.
A REVIEW OF THE INFLUENCE OF NONMETALLIC INCLUSIONS OF THE MECHANICAL PROPERTIES OF STEEL
Peter Thornton May 1970 77 p refs
(AD-707401; WVT-7032) Avail: CFSTI CSCL 11/6

The literature regarding the influence of nonmetallic inclusions on the mechanical properties of steel is reviewed, with critical comments on the various studies. Brief descriptions of four types of inclusion counting methods encountered in these studies, and a synopsis of the effects of applied stress on inclusions in an isotropic, elastic matrix, are presented. The parameters reviewed are tensile strength, impact strength, reduction of area, fatigue properties and fracture toughness. It is concluded that nonmetallic inclusions have a greater, explicit, effect on low cycle fatigue than on high cycle fatigue. Also, the effects of inclusions on mechanical properties are governed by their shape, size, quantity, inter-spacing, distribution, orientation, and physical properties relative to the matrix. Due to this number of variables, any general correlation between nonmetallic inclusion and mechanical parameters is highly improbable. Author (TAB)

N70-37889# Watervliet Arsenal, N.Y.
METALLOGRAPHIC TECHNIQUE FOR THE DEVELOPMENT OF MICROSTRUCTURAL CONSTITUENTS IN GUN STEEL
Theresa V. Brassard and Charles J. Nolan May 1970 20 p refs
(AD-707400; WVT-7029) Avail: CFSTI CSCL 11/6

An investigation was undertaken to develop etching procedures to clearly distinguish certain metallographic features of large forgings. The investigation demonstrates that (1) good microstructure resolution was obtained in untempered martensite using a 2% nital etchant, (2) either 25% sodium bisulfite in water or 4% picral plus hydrochloric acid yielded the best results for both tempered martensite and a duplex structure of tempered martensite and tempered lower bainite, and (3) an aqueous solution of 1% picric acid and 7% sodium tridecylbenzene sulfonate proved highly satisfactory in revealing both the prior austenitic grain boundaries and the macrostructure. Author (TAB)

N70-38007# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.

IMPLEMENTATION OF ADVANCED TECHNOLOGY FOR CAST METALS Final Report
George A. Colligan Mar. 1970 63 p refs
(Contract DAAG46-68-C-0048)
(AD-706221; AMMRC-CR-70-9) Avail: CFSTI CSCL 11/2

Phase equilibrium studies in the system ZrO2-MgO locate the eutectoid point at 13.7 mole % MgO at 1400C. Disagreement in the literature as to the position of the eutectoid point can be attributed to the difficulty in the attainment of equilibrium or method of analysis. A model of the stabilization process based primarily upon entropy of mixing effects alone satisfactorily explains the relative positions of the tetragonal + cubic - cubic phase field boundaries observed experimentally in various binary zirconia systems. Commercially significant conclusions are drawn as a result of these studies with respect to the process variables, time, temperature, and stabilization compound addition and identity to derive the true benefits of high quality ZrO2 refractory bodies. Author (TAB)

N70-38013# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE BASAL TEXTURES OF TI-6AL-4V PROCESSED BY VARIOUS METHODS Research Report, Jan. - Sep. 1969
Dennis L. Dull and Maurice F. Amateau 1 Feb. 1970 29 p refs
(Contract F04701-69-C-0066)
(AD-707517; TR-0066(5250-10)-15; SAMSO-TR-70-193) Avail: CFSTI CSCL 11/6

Basal (0002) pole figures were determined for Ti-6Al-4V alloy processed by various thermomechanical treatments, such as rolling, solution treating, forging, and annealing. The treatment temperatures ranged from room temperature to 1725F. At 1725F, no significant difference in texture resulted from different treatments. At 1400F and room temperature, however, the type of treatment influenced the texture. Author (TAB)

N70-38014# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
EFFECT OF SLIP CHARACTER ON FATIGUE STRIATION FORMATION
Hitoshi Ishii and Johannes Weertman 4 May 1970 8 p refs
(Contract Nonr-1228(32))
(AD-706318; TR-8) Avail: CFSTI CSCL 20/12

Electron microscope fractography was done on fatigued copper single crystals. Fatigue crack growth striations are found only on crystals oriented for double (multislip) slip and not on crystals oriented for single slip. Author (TAB)

N70-38081# Carnegie Inst. of Tech., Pittsburgh, Pa. Metals Research Lab.
THE EFFECT OF REVERTED AUSTENITE ON THE MECHANICAL PROPERTIES AND TOUGHNESS OF 12 Ni AND 18 Ni (200) MARAGING STEELS
Carlos A. Pampillo and Harold W. Paxton 1 Jun. 1970 39 p refs
(Contract Nonr-760(14))
(AD-707083) Avail: CFSTI CSCL 11/6

The effect of reverted austenite, of inclusion density, and of overaging of hardening precipitates, separately and together, on the strength and toughness of some maraging steels was investigated. The presence of reverted austenite does not necessarily improve toughness, and can in fact contribute measurably to increased yield strengths. Some speculations are presented on the role of retained austenite in these steels, and on the influence of the dislocations produced during the original austenite-martensite transformation. Author (TAB)

N70-38094# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
AN X-RAY STUDY OF FAULTING IN BCC METALS AND ALLOYS
Robert L. Rothman and Jerome B. Cohen 1 May 1970 34 p refs
(Contract N00014-67-A-0356-0008)
(AD-706371; TR-3) Avail: CFSTI CSCL 20/2

Faulting on (211) planes has been reported in filings of many b.c.c. materials based on differences in the broadening of various peaks in the x-ray powder pattern. These experiments have been repeated in this work using (a) recent techniques for correcting for various experimental errors and (b) new derivations of effects of faults on other planes. The results indicate that there are no faults produced by filing in Fe, beta-brass, and Mo-Re alloys. For Nb there are faults on (110), and concentration varies inversely with the interstitial content. Author (TAB)

N70-38103# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
CHEMICAL VAPOR DEPOSITION STUDY Semiannual Progress Report
A. Sosin 15 Apr. 1970 26 p refs
(Contract DAHC15-69-C-0127; ARPA Order 1285)
(AD-706794; UTEC-MSE-70-062) Avail: CFSTI CSCL 11/6

The tensile properties of C.V.D. tungsten in the as-received condition were measured at a strain rate of 0.02/min from 800C to 1400C in a helium gas atmosphere; Grain growth studies have been completed for isothermal anneals of up to thirty hours at fourteen temperatures between 1290C and 2780C for a tungsten-22 wt. % rhenium alloy; Efforts to accurately calibrate residual stress determinations using a split ring of tungsten with an internal strain gage were continued; and An inverse pole figure was determined for a flat piece of C.V.D. tungsten. TAB

N70-38104# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF DEVELOPING MACHINE-BUILDING TECHNOLOGY: SELECTED CHAPTERS
D. A. Prokoshkin et al 24 Apr. 1970 117 p refs Transl. into ENGLISH from Probl. Razvitiya Tekhnol. Mashinostr. (Moscow), 1968 p 33 - 66, and p 79 - 109
(AD-707114; FTD-MT-24-24-70) Avail: CFSTI CSCL 11/6

The chapter presents background material, such as formulae, atomic diagrams, lab test data, before elaborating on the high strength properties of steel. High-temperature thermomechanical treatment and low-temperature mechanical treatment are discussed at length, drawing on published data dealing with various steels. Two-stage thermomechanical treatment is discussed. The chapter makes a fairly comprehensive review of the description, physical and chemical properties, and specific uses and treatment of light aluminum alloys. But here, as in Chapter 2, no or very little attention or acknowledgement is given to American and Western Europes contribution in the field of light aluminum alloy research and development. TAB

N70-38150 Case Western Reserve Univ., Cleveland, Ohio.
EFFECTS OF METALS, MOLDING SAND COMPOSITION AND CASTING SHAPE ON MOLD WALL MOVEMENT
Michael Francis Bertolino (Ph.D. Thesis) 1968 240 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 69-9392

The influence of variables on mold cavity enlargement are expressed quantitatively. The amount of mold cavity enlargement was largest for ductile iron, followed by inoculated gray iron, uninoculated gray iron, steel and white iron in that order, with the smallest mold dilation occurring with copper base alloys. The mold wall movement was higher for metals that solidify with the formation of eutectic graphite because of the expansion during eutectic solidification and resulting pressure on the mold wall. Changing from green to dry sand molds reduced mold cavity enlargement considerably more for the nongraphite metals than for

those forming graphite during solidification. Final casting dimensions are established shortly after pouring steel, white iron, and non-ferrous metals; the casting dimensions continue to enlarge for gray and ductile iron until completion of the eutectic reaction. Differences in the liquidus-solidus temperature range of 0 to 329 for the copper alloys did not influence mold cavity enlargement to any measurable extent. Dissert. Abstr.

N70-38163# California Univ., Livermore. Lawrence Radiation Lab.
EMBRITTLEMENT OF VARIOUS STEELS BY ABSORPTION OF HYDROGEN FROM WET HYDROGEN SULFIDE [VERSPROEDUNG VERSCHIEDENER STAEHLE DURCH WASSERSTOFFAUFNAHME AUS FEUCHTEM SCHWEFELWASSERSTOFF]
Erich E. Hofmann et al. Oct. 1969 19 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (West Ger.), v. 39, 1968 p 677-682
(PB-188133T; UCRL-Trans-10407) Avail: CFSTI CSCL 11F

Effects of chemical composition, initial hardness, cold deformation, grain size, duration of action of the hydrogen sulfide, hydrogen sulfide content in the acting medium, and of the conditions of action on the embrittlement of various plain carbon, alloy, and alloy steels. Author (USGRDR)

N70-38198* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING FIBER REINFORCED METALLIC COMPOSITES Patent
John W. Weeton, David L. McDaniels, Robert W. Jech, Robert E. Oldrieve, Donald W. Petrasek, inventors (to NASA) et al. Issued 30 Jun. 1964 (Filed 21 Oct. 1960) 3 p Cl. 22-203
(NASA-Case-XLE-00231; US-Patent-3,138,837; US-Patent-Appl-SN-64226) Avail: US Patent Office CSCL 11F

A method is described for producing a high strength and high strength-density ratio material for application at normal room and elevated temperatures. A composite material composed of many high strength fibers such as tungsten is surrounded by and dispersed in a lower strength but more ductile matrix or binder such as copper. The fibers have a diameter of less than 0.010 inch and a length equal to the full length of the specimen. Within the composite, fibers are oriented parallel to each other and parallel to the long dimension of the specimen and extend the full length of the stressed portion of the product. The specimens are heated under a protective atmosphere while being held in position by a wire helix or ceramic tube. After the fibers have been infiltrated by the matrix material, the composites are cooled and the helix or restraining tube removed. R.B.

N70-38258# National Bureau of Standards, Washington, D.C. Heat Div.
ELECTRICAL RESISTANCES OF WIRES OF LOW TEMPERATURE COEFFICIENT OF RESISTANCE USEFUL IN CALORIMETRY (10 TO -380 K)
G. T. Furukawa, M. L. Reilly, and W. G. Saba *In its* Precision Meas. and Calibration Feb. 1970 p 110 ref Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

The resistance of some alloy wires was measured in the range 10 to 380 K as a part of the program in low temperature calorimetry to simplify and improve the accuracy in determining electric power introduced into the resistance heater of adiabatic calorimeter vessels. The goal is to achieve regularly an accuracy of 0.001% in the determination of power. The total energy introduced is the time integral of the product of instantaneous voltage across the heater and current through the heater. The resistance of two alloy wires Evanohm and Karma was found from the results of the measurements to change considerably less than constantan or manganin wire below 250 K. Author

N70-38278# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
MEASUREMENTS OF THE THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF PLATINUM FROM 100 TO 900 C
D. R. Flynn and M. E. O'Hagan *In its* Precision Meas. and Calibration Feb. 1970 p 334-357 refs Submitted for publication (See N70-38251 21-33)
(Grant AF-AFOSR-1025-66)
Avail: SOD $5.00

The good agreement among the thermal conductivity values obtained for platinum by two different methods in the present investigation and by an independent measurement indicates that the thermal conductivity of platinum increases with temperature. Electrical methods of measuring thermal conductivity can yield equivalent results to those obtained by the more conventional nonelectrical methods, at least for the conditions of this investigation. This can be interpreted as indicating that the thermal-conductivity of platinum does not depend significantly on electric current densities in the range less than 10,000A/sq cm. Before platinum can be established as a thermal conductivity reference standard, additional measurements by the same method on samples of differing purity are indicated. Author

N70-38279# National Bureau of Standards, Washington, D.C.
EMISSIVITIES OF METALLIC SURFACES IN AT 76 K
M. M. Fulk and M. M. Reynolds *In its* Precision Meas. and Calibration Feb. 1970 p 358-361 refs Submitted for publication (See N70-38251 21-33)
Avail: CFSTI

Heat transport by radiation between surfaces at 300 K and 76 K was measured to evaluate the effective emissivities of a number of technical grade or commercially available metals with unknown metallurgical history. The surface with the lowest total hemispherical emissivity was an unbuffed silver-plated surface. It was found that the emissivity of surfaces was lowest when used without any mechanical working and that the ability to absorb radiant energy varied with the length of time the surface was kept cold, even at a pressure less than 0.000001 mm Hg, indicating surface contamination by residual gases. Author

N70-38303# Army Chemical Center, Edgewood, Md. Industrial Operations Div.
SUCCESSFUL GAS QUENCHING OF 6061 ALUMINUM ALLOY Technical Report, Jul. 1966 - Jul. 1967
Francis B. Gurtner, Paul K. Shutt, Jr., and Frank T. Kirk, Jr. Apr. 1970 34 p
(AD-706842; EA-TR-4375) Avail: CFSTI CSCL 11/6

The investigation was directed toward gas quenching of thin walled items (0.040 thickness). It has not, however, been limited just to thickness of material but also to design and quality requirements that do not lend themselves to conventional quenching methods. Gas quenching requirements are many, but the following characteristics are being investigated: (1) Gas entrance and exit - number of orifices and orientation; (2) volume of gas (CFH) per load - cross section of material being quenched; and (3) distribution system - essential and relative to type of furnace and part configuration. The progressive attitude throughout the investigation proved that containers can be gas quenched to a T-4 solution condition, aged to T-6, and verified by physical properties and hardness values. The physical properties and hardness values have been taken over several hundred actual hardware items to determine the bank width or variation. If simulated samples were used in the gas quenching process, extrapolation would be necessary. None of the containers were distorted in this process. The quenching by gas from 980F is accomplished in the same container or furnace as the heating and soak time. In order to maintain physical properties, material must be removed from the furnace in a very short period

of time to reduce the effect of residual heating. Successful gas quenching was accomplished in a retort developed by Edgewood Arsenal personnel. Author (TAB)

N70-38318# Technische Hochschule Munchen (West Germany). Inst. fuer Technische Mechanik.

STRESS CONCENTRATION WITH FATIGUE LOADING Technical Summary Report, 1 Jan. 1967 - 31 Oct. 1968

Heinz Neuber and Ludwig Bertele Wright-Patterson AFB, Ohio AFML Feb. 1970 65 p refs

(Contract F61052-67-C-0017)

(AD-704583; AFML-TR-70-45) Avail: CFSTI CSCL 11/6

The fatigue strength reduction factor was experimentally determined for various steels: St 42 K, Ck 60, 30 CrNiMo8 and 100 Cr 6. Different deliveries of the St 42 K were fatigued in the following conditions: as-received, stress annealed and soft annealed. The chemical composition and the mechanical properties of the materials were determined and axial fatigue tests performed at room temperature with a frequency of 2000 cpm and 500 to 700 cpm respectively with cylindrical smooth and circumferentially notched specimens. The results of the tests were analyzed with Neuber's theory of stress mean value. In addition the test results were compared with other methods of the precalculation of the fatigue strength reduction factor. Author (TAB)

N70-38334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FURTHER OBSERVATIONS ON THE FORMATION OF SIGMA PHASE IN A NICKEL-BASE SUPERALLOY (IN-100)

Robert L. Dreshfield and Richard L. Ashbrook Washington Sep. 1969 31 p refs

(NASA-TN-D-6015; E-5821) Avail: CFSTI CSCL 11F

Sigma-free, moderately, and very sigma prone cast IN-100 were exposed at 1550 F for 250 and 2500 hours to permit sigma to form. As sigma increased, rupture life, tensile strength and ductility decreased. Yield strength at room temperature increased after exposure for 250 hours. Exposure times of 2500 hours caused the yield to approach or fall below the as cast value. Sigma isothermal transformation curves were prepared for wrought and cast IN-100 having essentially the same compositions. Wrought material exposed in a stress gradient at 1550 F was examined for stress effect on sigma formation. Author

N70-38347# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.

THERMODYNAMICS OF PRECIPITATION AND TRANSFORMATION IN SOLID STEELS Final Report, 1 Mar. 1967 - 31 Mar. 1970

John Chipman and John F. Elliott 5 May 1970 12 p refs

(Contract DAHC04-67-C-0036)

(AD-706909; AROD-6513-6-MC) Avail: CFSTI CSCL 11/6

The objective of the project was to secure accurate laboratory data which could serve as a basis for a complete thermodynamic description of the changes occurring in the heat treatment of carbon and alloy steels. The important changes considered are the transformations from liquid to solid, and from austenite to ferrite, and precipitations of graphite, cementite and other carbides from the liquid or solid phases, particularly from austenite. These changes and combinations thereof control the ultimate structure and, hence, the strength and toughness of the steel. The classic approach to the problem utilizes phase diagrams to show the limits of composition and temperature for each phase of the alloy system under equilibrium conditions. A second objective was the development of a method of computation which makes such diagrams unnecessary. Author (TAB)

N70-38376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF REACTOR IRRADIATION ON DUCTILE-BRITTLE TRANSITION AND STRESS-STRAIN BEHAVIOR OF TUNGSTEN

Charles L. Younger and Gilbert N. Wrights Washington Sep. 1970 25 p refs

(NASA-TN-D-5991; E-5338) Avail: CFSTI CSCL 11F

The effect of reactor irradiation at 250 F on the ductile-to-brittle transition behavior of polycrystalline tungsten in the recrystallized condition was investigated. Unirradiated material showed transition at 600 F, but when irradiated to 12×10 to the 19th power fast neutrons sq cm, the transition occurred at 1460 F. Irradiation strengthened the metal and caused plastic strain to be concentrated within a small-volume element of the test specimen gage section. Author

N70-38446# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

VANADIUM ALLOY CLADDING DEVELOPMENT Quarterly Progress Report, Period Ending 31 Mar. 1970

Apr. 1970 25 p refs

(Contract AT930-1)-3791)

(WARD-3791-46) Avail: CFSTI

Preparation of V and V alloys for stability evaluation and corrosion testing is summarized. Results of irradiation testing of vanstar-8 and vanstar-9 are reported. NSA

N70-38448# Rensselaer Polytechnic Inst., Troy, N.Y.

SUBSTRUCTURE EFFECTS UPON DIFFUSIVE TRANSPORT IN METALS Final Report, 30 Sep. 1965 - 1 Jun. 1969

George S. Ansell 1 Jun. 1969 8 p refs

(Contract DA-31-124-ARO(D)-423)

(AD-707467; AROD-5898-1-MC) Avail: CFSTI CSCL 11/6

Quantitative measurements were to be made of the rate of diffusive transport of interstitial solute atoms through metals at relatively low temperatures in order to study in detail the possible role of substructure in this process. The experimental studies pursued centered in two areas. The first was the direct measurement of hydrogen permeation through thin samples of palladium and iron at low pressures and temperatures. The second area of study was concerned with the development of microanalysis techniques which could be used to determine microsegregation over small areas, such as near grain boundaries in metals. Here, the emphasis was placed on the application of thin film combined electron probe-electron microscope techniques. A method was developed which allowed for the determination of solute segregation over areas which are smaller than the electron beam size in these instruments. Author (TAB)

N70-38464# Technische Hochschule Munchen (West Germany). Inst. fuer Technische Mechanik.

THERMAL FATIGUE Final Report, 1 Jul. 1966 - 31 Dec. 1967

Heinz Neuber and Hans Riege Mar. 1970 109 p refs

(Contract AF 61(052)-718)

(AD-706375; AFML-TR-68-301-Pt-2) Avail: CFSTI CSCL 11/6

Creep and thermal cycling tests with cold-drawn and standard heat treated Nimonic 80A wires were performed at several tensile stress levels. The interrelationships of deformation and fracture behavior under constant and cyclic temperature conditions were investigated quantitatively. The changes of microstructure and of several physical and mechanical material properties, such as electrical resistivity, internal friction and hardness after precreep and thermal precycling have been studied intensively. The acceleration effects of thermal cycling on creep rate and fracture were explained by thermal microstresses arising at the precipitates on account of different coefficients of thermal expansion of matrix and precipitate. A modified creep law is proposed. The effects of cyclic stress superimposed to a constant mean tensile stress on the creep behavior of cold-drawn Nimonic 80A were investigated with tests carried out on a tension testing machine combined with a high

temperature furnace. The creep laws under constant and alternating stress conditions were quantitatively compared by a suitable parameter-method. Author (TAB)

N70-38490* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REINFORCED METALLIC COMPOSITES Patent
David L. McDanels, Robert W. Jech, John W. Weeton, and Donald W. Petrasek, inventors (to NASA) Issued 9 Apr. 1963 (Filed 21 Oct. 1961) 3 p Cl. 29-183.5
(NASA-Case-XLE-00228; US-Patent-3,084,421;
US-Patent-Appl-SN-64224) Avail: US Patent Office CSCL 11F

Reinforced metallic composites with high strength and high strength-density ratio, high ductility, and low notch sensitivity for application at cryogenic and elevated temperatures are described. Short length fibers are packed closely, with the longitudinal axes parallel, in a ceramic tube or circular mold. The articles are then heated and molten matrix is added. The resulting composite has the same strength as one using full length fibers, and maintains the original size, shape, and orientation of fibers. N.E.N.

N70-38518# Argonne National Lab., Ill.
CALCULATIONS OF THE THERMODYNAMIC DRIVING FORCE FOR CARBON TRANSPORT IN SODIUM-STEEL SYSTEMS
K. Natesan and T. F. Kassner Dec. 1969 28 p refs
(Contract W-31-109-eng-38)
(ANL-7646) Avail: CFSTI

The thermodynamic activity and solubility of carbon in Fe-Cr-Ni alloys were calculated in the temperature range 500 to 800 C by extrapolation of higher-temperature data in the Fe-Cr-C and Fe-Ni-C systems. The compositional range for the alloys included that of an 18-8 austenitic stainless steel. These results were used with phase equilibria information and data for the solubility of carbon in sodium to obtain an equilibrium relationship between the total carbon content in the alloys and carbon concentrations in sodium. The calculations showed that the Fe-Cr-Ni alloys with nominal initial carbon contents may undergo carburization or decarburization depending upon the carbon concentration in sodium and the temperature the range 500 to 800 C. Author (NSA)

N70-38536# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
EVALUATION OF THE QUALITY OF SEAMLESS AUSTENITIC STAINLESS STEEL TUBING
T. Lauritzen, J. J. Albanese, G. C. Berg, and G. G. Gaul Dec. 1969 44 p ref
(Contract AT(04-3)-189)
(GEAP-13553) Avail: CFSTI

A compilation of data representing the complete quality assessment of several heats of thin wall seamless tubing is presented. The work was performed on commercial size lots of the five austenitic stainless steel Types-304, -316, -321, -347, and Incoloy-800. The results served to demonstrate the relative capabilities of the several manufacturers to produce high quality seamless tubing and emphasized items in the production and inspection processes that require attention in the eventual large-scale ordering of austenitic stainless steel for canning fast reactor fuel. Author (NSA)

N70-38537# Oak Ridge National Lab., Tenn.
CHEMICAL VAPOR DEPOSITION OF VANADIUM AND VANADIUM ALLOYS: A FEASIBILITY STUDY
J. I. Federer May 1970 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2923) Avail: CFSTI

Vanadium has been vapor-deposited by H2 reduction of VCl4 and VF5 in the temperature range 900 to 1200 C. The efficiency of V deposition from VCl4 was only about 8% at 900 C, but increased to about 50% at 1100 and 1200 C. Lower chlorides of V always deposited with the metal. Only VF3 was obtained by hydrogen reduction at VF5 at 900 C; however, the efficiency of V deposition was about 80% at 1000 and 1100 C, and increased to 100% at 1200 C. Tubular deposits exhibited thickness variations due to depletion of VCl4 or VF5 in the gas mixture. The total impurity concentrations of the deposits ranged between 0.6 and 1.2%. The grain structure of the deposits was coarsely columnar and the grains had a strong 110 orientation. Hardness values ranged from 390 to 695 dph depending upon the impurity content. Attempts to deposit Ti and Cr from TiCl4 and CrCl4 for the purpose of preparing alloys with V were generally unsuccessful due to formation of lower chlorides. Author (NSA)

N70-38538# National Lead Co. of Ohio, Cincinnati.
MULTIPLE DIRECT CASTING OF NPR BILLETS FROM A SINGLE MELT
R. J. Titmuss Apr. 1970 15 p refs
(Contract AT(30-1)-1156)
(NLCO-1052) Avail: CFSTI

Techniques were developed to cast NPR billets directly to size in multiple molds thereby eliminating an extrusion operation. Induction-heated tundishes were used to distribute the uranium metal from a graphite crucible into three graphite molds for the inner billet and tow graphite molds for the outer billet. The machined billets were within all specifications except for surface quality. Very minute subsurface defects became visible after nitric acid pickling. Alloying additions of aluminum were made by introducing the aluminum, as pellets, directly into the molds. The aluminum was well distributed in the castings. Author (NSA)

N70-38568*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF CAVITATION DAMAGE TO HIGH-PURITY METALS AND A NICKEL-BASE SUPERALLOY IN WATER
Stanley G. Young Washington Sep. 1970 31 p refs
(NASA-TN-D-6014; E-5688) Avail: CFSTI CSCL 11F

Stationary specimens of unalloyed zinc, nickel, iron, and tantalum and Udimet 700 were subjected to cavitation damage in water by means of a vibratory apparatus. Most test conditions were those established in an earlier ASTM round robin. Damage was maximum at separation distances of the specimen from a vibrating head of 0.015 to 0.020 inch (0.038 to 0.051 cm). The damage to stationary specimens was about half the damage to vibrated specimens of the same material. Cavitation damage was measured by volume loss and by surface roughness. Metallographic studies were conducted to determine the nature of damage. Author

N70-38593# Mound Lab., Miamisburg, Ohio.
HIGH TEMPERATURE REACTIONS OF GROUP VI A METALS WITH LUTETIUM AND FOUR REFRACTORY METALS
L. K. Matson 20 May 1970 14 p ref
(Contract AT(33-1)-Gen-53)
(MLM-1720) Avail: CFSTI

To obtain the reaction data between chalcogens, which are used as nonradioactive substitutes for polonium, and potential container metals, an apparatus was developed for monitoring the reaction between the metals and chalcogens. The reaction between tellurium and each of the metals lutetium, molybdenum, tantalum, tungsten, and rhenium was studied. The lutetium, molybdenum, and tantalum data were also described by the general parabolic equation. The preliminary data indicate that rhenium would be a good container material, that tungsten would be a fair container material, and that molybdenum, tantalum, and lutetium would be poor container materials for tellurium and polonium. Further studies to test the container capabilities of rhenium were performed.

Corrosion experiments using tellurium and selenium were performed to determine whether there would be a reasonable probability of developing an isotopic fuel container for polonium using rhenium. The data suggest that rhenium might be a good container for polonium. Author (NSA)

N70-38628# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW MAGNETIC TEXTURED ALLOYS WITH INDUCTION LINEARLY DEPENDENT ON THE FIELD

A. I. Zusman 2 Feb. 1970 10 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 6, 1969 p 77–79
(AD-706658; FTD-HT-23-36-70) Avail: CFSTI CSCL 11/6

The article presents data on two new alloys, 47NKKh and 64N, developed at the Institute of Precision Alloys of TsNIIChermet for application in magnetic cores. The magnetic properties of the alloys are described and their qualities are compared to those of a previous alloy, 47NK, and the magnetodielectric TCh 180. TAB

N70-38630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CASTING PROPERTIES OF TITANIUM ALLOYS

O. N. Magnitskii 10 Apr. 1970 174 p refs Transl. into ENGLISH from the Russian
(AD-706642; FTD-HT-23-386-69) Avail: CFSTI CSCL 11/6

Results of experimental investigations on the following basic casting properties of titanium-based alloys are given: crystallization kinetics, fluidity, fillingness, tendency to fracture formation, etc. The report shows the effect of a series of factors on the casting properties of alloys and gives recommendations for ensuring a high quality of titanium-alloy castings. Author (TAB)

N70-38649# Battelle Inst., Frankfurt am Main (West Germany).

MICROFILAMENTS

Joachim Nixdorf and Horst Rochow *In its* Battelle Inform. No. 3 3 Jan. 1969 p 4–16 refs (See N70-38648 21-34)
Avail: CFSTI

A continuous process for producing microminiature wires (microfilaments) with diameters of about 30 microns, based on Taylor's method, is described. Production experiences, microfilament mechanical properties, comparisons with whiskers, and possible applications are also described. ESRO

N70-38650# Battelle Inst., Frankfurt am Main (West Germany).

EXPLOSIVE CLADDING OF METALS

Werner Geiger, Karl-Heinz Schramm, and Walter Wolf *In its* Battelle Inform. No. 3 3 Jan. 1969 p 17–18 (See N70-38648 21-34)
Avail: CFSTI

Flat cladding processes for bonding most metals, using explosives, are described. Although mainly used for flat plates they can be used for cladding the internal and external surfaces of tubes. ESRO

N70-38686 Rice Univ., Houston, Tex.

THE FABRICATION AND PROPERTIES OF BOAT EVAPORATED PERMALLOY THIN FILMS

Kent Randall Carson (Ph.D. Thesis) 1969 253 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.30 Order No. 69-19270

All major aspects of the boat evaporation of permalloy thin films were characterized. The evaporation and vacuum equipment were evaluated first. This included analyses of substrate temperature, the magnetic field, the evacuation parameters, and the cleaning, orientation, heating rate, and temperature of the boats. The bulk properties and surface condition of typical glass substrates were studied. The functional dependence of the gross physical film properties on the deposition parameters was charted. A technique was developed to sample the vapor as a function of time. The effects of varying deposition conditions on the formation of composition gradients through the film thickness were studied. The formation of the Ni–Fe–W ternary alloy and its effect on vapor emission, the rate of evaporation, and the partial pressures of Ni and Fe were analyzed. The individual energy parameters were briefly defined and the ways in which they can be of use in thin film research were outlined. Dissert. Abstr.

N70-38723# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF CARBIDE REGION OF TA-HF-C SYSTEM

V. S. Emelyanov et al 19 Jan. 1970 11 p refs Transl. into ENGLISH from the Russian
(AD-706196; FTD-MT-24-362-69) Avail: CFSTI CSCL 11/6

Carbide combinations of the system Ta-Hf-C are of definite interest in view of their high melting points (e.g. the m.p. of the complex carbide 4TaC times HfC is approximately 3942 degrees centigrade). In this connection the carbide region of this system was investigated with respect to specimens of 51 different alloys whose compositions lie on the sections TaC-HfC and Ta(subscript 2)C-HfC of the constitution diagram. Isothermal sections of this ternary system were accordingly studied by methods of x-ray and metallographic analysis of alloys quenched from 2400 to 1500 degrees centigrade along with measurements of microhardness of these alloys. In all the investigated alloys the melting point did not exceed the melting points of the carbides of tantalum and hafnium, even though it was extremely high(3280-3840 degrees centigrade). A comparison of the isothermal section of the ternary system Ta-Hf-C at 1500 degrees centigrade with its counterpart at 2500 degrees centigrade showed no difference. It is shown that the lattice parameter increases with decrease in its C content and increase in its HfC content. The existence of the complex carbide (ta, Hf)C is established and the region of its homogeneity at high temperatures is defined. The melting point of the eutectic in the system HfC-C is lower (3230 degrees centigrade) than the melting point of the eutectic in the system TaC-C. Author (TAB)

N70-38749# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

COMPARISON OF THREE ALLOYS FOR CLUSTER SUPPORT APPLICATION IN NERVA REACTORS

J. B. McAndrew Feb. 1970 36 p refs
(WANL-TME-1995) Avail: CFSTI

Three alloys that have been considered for cooled cluster support components in NERVA reactors are discussed. The alloys are Inconel 718, Waspaloy, and A-286. Each is described in terms of general metallurgy, thermophysical and mechanical properties, and applicable environmental effects. Engineering judgment is employed where specific data needed are not available. The principal conclusion is that Inconel 718 is the best choice for this application. It is also concluded that with the present state of knowledge concerning properties of the alloy in this unique environment, temperature should be limited to 1300 R for stresses such as 50 or 60 ksi. If stresses are not higher than 15 ksi, a temperature of 1500 R should be allowed. Author (NSA)

N70-38810 National Lending Library for Science and Technology, Boston Spa (England).

RADIATION CREEP OF URANIUM AND GRAPHITE

P. A. Platonov et al 2 Apr. 1970 15 p refs Transl. into ENGLISH from Russian Conf. Paper Presented at IAEA Symp. on Radiation Damage in Reactor Mater., Vienna, 2–6 Jun. 1969
(NLL-CE-Trans-5226-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Creep and stress relaxation results are given for alpha-uranium and uranium alloy, containing 9% molybdenum in the homogeneous and heterogeneous states, irradiated at a temperature of 60 to 100

C with a thermal neutron rate 5 × 10 to the 12th power to 5 × 10 to the 13th power neutrons/sq cm s. The nature of the creep radiation curves for alpha and gamma-uranium differ from each other, the creep of alpha-uranium is characterised both by a transient and stable stage, while in the creep of gamma-uranium only the transient stage is observed. Both the transient and stable creep rate are proportional to the applied stress. A comparison of creep and stress relaxation data indicates that there is a certain correlation between the two effects. Test results on polycrystalline reactor graphite are described for creep irradiated in a reactor at temperatures 100 to 900 C and in the range of integral fluxes 10 to the 20th power to 10 to the 21st power neutrons/sq cm. Analysis of the results indicates that in the case of graphite, and alpha-uranium, there are two stages of creep. Author

N70-38827# Technische Hochschule Munchen (West Germany). Inst. fuer Technische Mechanik.
THERMAL FATIGUE, PART 1 Annual Summary Report, 1 Jul. 1965 – 30 Jun. 1966
Heinz Neuber and Hans Riege Wright-Patterson AFB, Ohio AFML Feb. 1970 109 p refs
(Contract AF 61(052)-718)
(AD-706376; AFML-TR-68-301-Pt-1) Avail: CFSTI CSCL 11/6

Creep and thermal cycling tests with colddrawn Nimonic 80 A wires were performed at several stress levels. The deformation and fracture behavior was compared quantitatively. The changes of several physical and mechanical material properties, such as electrical resistivity, internal friction and hardness after thermal cycling and creep pretreatment, have been studied intensively. Creep and stress cycling tests at high temperatures were conducted in an electronic tensile testing machine and in a high frequency push-pull fatigue machine. Both testing machines are described and the principles of analysis for the treatment of cyclic stress tests are given. Author (TAB)

N70-38863 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF PROLONGED HEATING ON THE PROPERTIES OF CONDUCTOR COPPER
N. L. Pravoverov 2 Apr. 1970 8 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), v. 39, 1968 p 59 – 61
(NLL-CE-Trans-5110-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

It is shown that with prolonged heating (1500 h) of conductor copper mark M1 at 400 and 700 C, both large and small pores are formed in its structure. The pore formation is accompanied by a reduction in the strength, ductility, and electrical conductivity of the copper. Author

N70-38970 Rensselaer Polytechnic Inst., Troy, N.Y.
AN INVESTIGATION OF THE EFFECTS OF THERMAL HISTORY AND COMPOSITION OF THE OCCURRENCE OF AN AUSTENITE DUCTILITY TRANSITION IN LOW-CARBON STEEL
Gordon A. Wilber (Ph.D. Thesis) 1969 17 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-17907

A large number of specimens from a single, low-carbon heat of steel were mechanically tested in the temperature range of 1300 to 2700 F after various thermal cycles. The results substantiated the existence of an austenite ductility transition at about 2200 F on cooling after casting in situ and also demonstrated that a reverse transition from low to high ductility occurred on continued cooling at about 1500 F. Variations in the thermal history showed that the low ductility below 2200 F could be (1) minimized by relatively short isothermal holds prior to testing, (2) eliminated by passing through the lower allotropic transformation before reheating directly to the test temperatures, and (3) re-introduced after allotropic transformation by reheating above the test temperatures and then cooling. It was also shown using the same heat that an austenite ductility transition similar to that observed after casting in situ could be introduced in unmelted specimens. An extensive metallographic examination of the tensile specimens after thermal cycling showed evidence of a compositional variation at the austenite grain boundaries. Dissert. Abstr.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-37614# Gulf General Atomic, San Diego, Calif.
MECHANISMS OF DEGRADATION OF POLYMERIC THERMAL CONTROL COATINGS. PART 2: EFFECTS OF RADIATION ON SELECTED PIGMENTS Final Report, 1 Sep. 1968 – 30 Nov. 1969
Tomas E. Firle and Terry M. Flanagan Mar. 1970 113 p refs
(Contract F33615-69-C-1055)
(AD-706127; GA-9853-Pt-2; AFML-TR-68-334-Pt-2) Avail: CFSTI CSCL 11/3

An investigation has been conducted on the mechanisms of degradation of pigments and polymeric coatings for thermal control applications exposed to ultraviolet (uv) and electron irradiation. The materials investigated were rutile (titanium dioxide) and strontium titanate (SrTiO3). The effects of treating the pigments by heating in various gas ambients at elevated temperatures were studied using gas chromatography and electrical conductivity measurements. Significant changes in the surface characteristics were found to result from these treatments. A comparison was made between the reflective degradation in binderless pigments and silicone-binder coatings exposed to uv light, to energetic electrons, and simultaneously to uv light and electrons. Evidence for stabilization of defect sites by charge capture was discovered in the binderless pigment experiments. This mechanism for defect stabilization does not appear as prevalent in the silicone-binder coatings, since the binder apparently passivates the pigment surface to some extent. The fluence dependence of the degradation and the recovery of the damage in vacuum and in the presence of various gas ambients was also studied. Author (TAB)

N70-37636# Oak Ridge National Lab., Tenn.
PREPARATION OF MgO POWDER HAVING LOW Al AND Fe CONTENT
R. B. Quincy, Jr., C. T. Butler, B. J. Sturm, and D. E. La Valle May 1970 14 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2935) Avail: CFSTI

A method is presented by which some impurities, especially Fe and Al, are precipitated as hydroxides from aqueous Mg(NO3)2. This is accomplished by adjusting the pH to between 7.5 and 8.3 with NH4OH. The filtered solution is made strongly basic to precipitate Mg(OH)2 which is then calcined to MgO. This product has < 5 ppm Al and < 1 ppm Fe. Author

N70-37646# California Univ., Livermore. Lawrence Radiation Lab.
COMMENTS ON SOURCES AND ANALYSIS OF MOISTURE IN PSB FOAM
Bert Holder 12 May 1970 9 p Sponsored by AEC
(UCRL-72453) Avail: CFSTI

Two analytical methods are discussed for analyzing water

in PSB foam. Both methods are subject to approximately the same degree of precision of 20 micrograms with normal handling. Accuracy requires that the system be checked periodically against standard materials. R.B.

N70-37661# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ALUMINUM-GRAPHITE COMPOSITES. July 1969 - February 1970
Roger T. Pepper, John W. Upp, Ronald C. Rossi, and E. George Kendall 1 Apr. 1970 32 p refs
(Contract F04701-69-C-0066)
(AD-706883; TR-0066(9250-03)-3; SAMSO-TR-70-174) Avail: CFSTI CSCL 11/4

Room temperature uniaxial tensile tests have shown that composites of eutectic aluminum - silicon alloy and Thornel 50 graphite fibers have strengths greater than a theoretical value that was calculated on the basis of the law of mixtures. At 28 vol % fibers, the average uniaxial tenle strength was found to be 106,000 psi, and several values between 130,000 and 144,000 psi were obtained. The modes of fracture in the composites have been studied by the microexamination of polished surfaces and fractures of tested specimens. Specimens of the composite have been thermally cycled between -193C and +20C and -193C and +500C 20 times. Tensile tests and microexamination of the thermally cycle specimens show that thermal cycling does not degrade the tensile properties of the composites or change their microstructure. Author (TAB)

N70-37726# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PALARITE THERMAL INSULATION
C. D. Reynolds and Z. L. Ardary 28 Apr. 1970 51 p refs
(Contract W-7405-eng-26)
(Y-1716) Avail: CFSTI

Palarite (a substance that consists essentially of carbon-bonded silica fibers) is generally prepared with densities in the range of 7 - 10 pounds per cubic foot (pcf), using a vacuum-molding process. The thermal conductivity of 8-pcf Palarite increases from 0.25 Btu in/hr.-deg F-sq ft at 70 F to 0.60 Btu in/hh-deg F-sq ft at 1,000 F. However, in air, oxidation of the carbon binder begins at temperatures above 500 F. Author

N70-37774# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
THERMAL CONTROL COATINGS: AN ANALYTICAL TREATMENT Technical Report, Mar. - Jun. 1969
Max A. Turner and Carl P. Boebel Mar. 1970 35 p refs
(AD-706128; AFML-TR-70-8) Avail: CFSTI CSCL 22/2

The need for various types of thermal control coatings has been derived and summarized from an analysis of selected thermal problems frequently encountered in spacecraft hardware coupled with an analysis of variance in the parameters of the thermal balance. This overall analysis indicates the need for a complete series of stable coatings each having a minimum (0.1 or lower) solar absorptance but with different or controllable values of infrared emittance ranging from 0.3 to 1.0 in order to cover the entire range of desirable solar absorptance/emittance ratios from 0.1 to 0.3. This analysis was applied only to a generalized earth orbiting spacecraft. Where internal heat dissipation rates exceeded several watts/sq. ft., active heat removal systems would be required. Author (TAB)

N70-37868# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Lab.
PREPARATION OF HIGH-MODULUS FIBERS BY MASS TRANSPORT DURING FILM BOILING
Vernon A. Nieberlein 5 Jan. 1970 58 p refs
(AD-706836; RR-TR-70-2) Avail: CFSTI CSCL 11/5

A process for the preparation of SiC-on-tungsten fibers, was investigated. The process uses, instead of conventional vapor deposition, the mass transport associated with film boiling on an incandescent wire while submerged in a liquid reactant. The diameter of the deposit was used as a measure of the mass transport rate. Analyses of rates were made in both the kinetic limited regime and the diffusion limited regime. Variables investigated were concentration of the plating solution, voltage applied across the filament and position on the filament. The results obtained for mass transport rates were quite analogous to those obtained for heat transfer rates during film boiling and to heat transfer rates during free convection of a gas. Author (TAB)

N70-37873# IIT Research Inst., Chicago, Ill.
MICROWAVE DIELECTRIC CONSTANT MATERIALS, TASK 2 Quarterly Report, 1 Oct. 1969 - 1 Jan. 1970
A. J. Mountvala, S. W. Freiman, R. M. Knox, and E. J. Onesto Apr. 1970 28 p refs
(Contract DAAB07-69-C-0402)
(AD-706824; IITRI-G6033-2; ECOM-0402-2; QR-2) Avail: CFSTI CSCL 11/2

Materials having a variety of dielectric properties have been prepared and characterized in order to check their performance at frequencies in the gigHz range. Heat treatment of BaTiO3 containing glasses were begun in order to precipitate high K BaTiO3 crystals. The equipment for measuring dielectric properties in the gigHz range has been assembled. Preliminary measurements designed to determine optimum techniques have been made on selected samples. Author (TAB)

N70-37978# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
DISPERSION STUDY OF DOMAIN WALL MOBILITY AND MECHANICAL DAMPING IN Pb(Ti, Zr) O3 TRANSDUCER CERAMICS Technical Report, 1 Dec. 1968 - 1 Dec. 1969
Helmut H. A. Krueger and Bernard Jaffe 1 May 1970 26 p refs
(Contract N00014-69-C-0048)
(AD-706793; TR-1) Avail: CFSTI CSCL 11/2

Resonant methods were used to measure the properties of Pb(Zr, Ti)O3 ceramics, emphasizing the mechanical Q sub M, over the temperature range -180C to +165C, and including specimens whose dimensions were chosen to give a frequency range of approximately 60 kHz to approximately 850 kHz. Examples of the curves of properties as function of temperature are shown. Loss (1/Q sub M) maxima appear to be outside this temperature-frequency domain for the compositions studied. On the other hand, loss minima (peaks in Q sub M) are often found. High temperature drop off in Q sub M is attributed to increasing conductivity. The mechanisms responsible for the losses at low temperatures are not clear, but may be related to the proximity of a phase transition. Some work is also described on quasi-static strain vs stress measurements. Author (TAB)

N70-38036# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF OIL SAMPLE DATA OBTAINED FROM AIRCRAFT ENGINES BY SPECTROMETRY
John Joseph Carty (M.S. Thesis) Oct. 1969 71 p refs
(AD-706697) Avail: CFSTI CSCL 11/8

The spectrometric oil analysis program as applied to naval aviation was developed as a portion of the overall aviation safety program of the U. S. Navy. The equipment and techniques have been refined, and the program has been steadily expanded since its inception in 1955. The value of this system in determining densities of microscopic particles of certain oil-wetted wear metals in samples of oil extracted from aircraft engines has proved to be helpful in predicting incipient engine failure. In this study data relating to both reciprocating and jet engine models was analyzed in an attempt to determine which of the following elements

provided significant information regarding the internal condition of the engine: aluminum, iron, chromium, silver, magnesium, nickel, copper, and silicon. Multiple and simple linear regression analyses and correlation techniques were applied in order to determine the mathematical model which corresponded most closely to the data compiled. Author (TAB)

N70-38060# Case Western Reserve Univ., Cleveland, Ohio.
SMALL ANGLE X-RAY DIFFRACTION FROM CRYSTALLINE POLYMERS Final Report, 9 Mar. 1967 - 31 Mar. 1970
P. H. Geil 31 Mar. 1970 29 p refs
(Grant DAHC04-67-C-0039)
(AD-706903; AROD-6938-1-C) Avail: CFSTI CSCL 11/9

Small angle x-ray diffraction and electron microscopic examinations were made of crystalline bulk polymers (polyethylene and polyoxyethylene) with particular respect to crystal thickness and regularity. Major problems attendant to pattern interpretation are examined. Author (TAB)

N70-38074# Commissariat a l'Energie Atomique, Saclay (France). Centre D'Etudes Nucleaires.
INTERNAL FRICTION OF CARBONS AND GRAPHITES [FROTTEMENT INTERIEUR DES CARBONES ET GRAPHITES]
P. Gobin, (Inst. Natl. Sci. Appl., Lyon), J. Merlin (Inst. Natl. Sci. Appl., Lyon), D. Rouby (Inst. Natl. Sci. Appl., Lyon), G. Jouquet, and J. Rappeneau
(CEA-Conf-1490) Avail: AEC Depository Libraries

The coefficient of internal friction was measured on a range of carbon materials, with a torsion pendulum at frequencies around 1 cps. Its evolution was determined for a strain extent from 0.00001 to 0.002, in the temperature range minus 180 to 500 C. Two main processes of energy absorption can be distinguished as a continuous background which can be connected to strain by a hyperbolic relationship and is slightly increased with temperature and a peak around 0 C, which appears to be a hysteresis peak and is analyzed by the Granato - Lucke model. The following conditions induce changes in these two components: graphitization process, neutron irradiation, annealing, thermomechanical treatments. The level of the continuous background rises with the degree of graphitization; it is reduced by low neutron doses. The higher the amplitude of the peak, the lower the degree of graphitization. The amplitude decreases with irradiation and the peak moves toward higher temperatures. Several mechanisms can be taken into account; dislocation motions, interactions between dislocations and point defects and between microcracks and point defects. Author (NSA)

N70-38090# Naval Ship Research and Development Center, Washington, D.C. Dept. of Structural Mechanics.
THE EFFECTS OF SIZE AND ENVIRONMENT ON THE UNIAXIAL COMPRESSIVE BREAKING STRENGTH OF GLASS, ALUMINA, AND PYROCERAM Final Report
Dionides H. Moreno and Marcel L. Salive May 1970 52 p refs
(AD-707340; NSRDC-3315) Avail: CFSTI CSCL 11/2

The effects of size and environment on the uniaxial compressive breaking strength of glass, alumina, and pyroceram were investigated to establish realistic design criteria applicable to deep-depth hulls and/or buoyancy systems of nonmetallic materials. The influence of specimen size (diameters of 1/2, 1, and 1 1/2 in.), test environment (air, atmospheric sea water, and sea water at 10 ksi) and strengthening level (50 and 100 ksi) are discussed and tentative conclusions drawn on the basis of test results for a limited number of specimens. Author (TAB)

N70-38101# RAND Corp., Santa Monica, Calif.
INELASTIC ANALYSIS OF A UNIDIRECTIONAL COMPOSITE SUBJECTED TO TRANSVERSE NORMAL LOADING
Donald F. Adams May 1970 53 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-707505; RM-6245-PR) Avail: CFSTI CSCL 11/4

An application of classical plasticity theory to analyze the behavior of a unidirectional composite material under transverse stress beyond the elastic limit, up to initiation of the first crack. Previous studies utilizing linear elastic analyses disregarded the high strain capability of the matrix materials and thus gave unrealistically low failure levels. The elastic-plastic analysis uses a finite element, tangent modulus solution technique. Contrary to the apparent linearity observed on a gross scale, the material is shown to be undergoing extensive yielding and redistributions of stress in local regions. The results show quantitatively the importance of local yielding and how it is influenced by variables such as the spacing and packing geometry of the reinforcing fibers, as well as by the filament and matrix material properties. Results agree well with the data available for boron/aluminum, boron/epoxy, and S glass/epoxy composites. Author (TAB)

N70-38152# Ceramic Finishing Co., State College, Pa.
STRENGTHENING OXIDES BY REDUCTION OF CRYSTAL ANISOTROPY
Henry P. Kirchner, Robert M. Gruver, and Regina A. Ewig Apr. 1970 55 p refs
(Contract N00014-66-C-0190)
(AD-707447; TR-3) Avail: CFSTI CSCL 11/2

Literature information was used to demonstrate that the grain size dependence of strength increases with increasing crystal anisotropy in well-made pure oxide ceramics. Based upon this information a large grain size dependence of strength was predicted for rutile TiO2 bodies. This dependence was verified by experiment. The lack of strength at large grain size was attributed to the presence of localized cracks formed by relief of stresses caused by thermal expansion anisotropy. The lengths of these cracks were measured and were used to calcualte the strengths of the bodies using the Griffith theory. Solid solution compositions with reduced thermal expansion anisotropy were available from previous investigations. Ceramic bodies of these compositions were prepared by hot pressing. Specimens of various average grain sizes were prepared and the strength vs. grain size was determined. The weight of the evidence available at present indicates that the grain size dependence of strength of the solid solutions with reduced thermal expansion anisotropy is less than that of the comparable pure oxides. Author (TAB)

N70-38158*# Norton Research Corp., Cambridge, Mass.
STUDY OF STRUCTURAL BEHAVIOR OF THIN FILMS Second Year Summary Report, 17 Sep. 1968 - 17 Sep. 1969
Frank Feakes and Earl E. Chadsey, Jr. Sep. 1969 90 p refs
(Contract NASw-1802)
(NASA-CR-112946) Avail: CFSTI CSCL 11D

A number of procedures aimed at increasing the strength of vacuum evaporated composite materials are investigated. The work included examination of the dimensional and weight changes in the polyimide substrate when exposed to the condition experienced during vacuum coating with boron and boron carbide. A detailed examination of the surface morphology of both the polyimide substrate and the vacuum deposited boron and boron carbide indicated that the most important crack nucleating defects appeared to be those associated with spit marks and microscopic droplets of molten material embedded in the deposit. Extended vacuum degassing of the polyimide substrate prior to coating did not substantially improve the adherence of the deposits to the polyimide. It did lower the strength of the polyimide and decrease its tear resistance. Author

N70-38323# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF HEATING AND FORGING OF TITANIUM ALLOYS WITH PROTECTIVE COATINGS

V. I. Zalesskii et al 30 Jan. 1970 12 p refs Transl. into ENGLISH from Kuznechno- Shtampovochnoye Proizv. (USSR), v. 10, no. 11, 1968 p 9-11
(AD-706179; FTD-HT-23-621-69) Avail: CFSTI CSCL 13/8

Several glass coatings were tested for their protective and lubricating effect during heating and forging of titanium alloys. Specimens of VT3 1 and OT4 1 titanium alloys heated to 80 degrees centigrade were dipped in a solution and dried at 80 degrees centigrade. A uniform, dense, tightly adhering coating 0.1-0.4 mm thick was obtained. The specimens were heated in an electric furnace to 1000 degrees centigrade and held for 1 hr. The coatings practically eliminated gas absorption. No metal losses or change of color occurred in coated specimens, whereas uncoated specimens lost 0.2-0.3 mm from each side. The lubricating properties of glass coatings were tested in upsetting VT5 titanium alloy cylindrical specimens at reductions of 30, 50, and 70 percent. The coatings considerably reduced friction and ensured uniform reduction during forming along the height of the specimens. The barrel effect in uncoated specimens was greater than in coated specimens. The ratio of end diameter to body diameter was 1.3 to 1.32 at 30 to 50 percent reduction in uncoated specimens, and 1.22 to 1.19 at 30 to 50 percent reduction in coated alloy. Coating also improved the elongation and reduction of area of OT4 1 alloy specimens over those of uncoated alloy without effecting the tensile strength or notch toughness. TAB

N70-38362# Du Pont de Nemours (E. I.) And Co., Circleville, Ohio.
WEAR OF POLYESTER FILM
D. J. Chalmers and K. L. Knox [1969] 14 p refs
Avail: CFSTI

Polyester film surface damage from scratching is studied as a problem where appearance is critical or where absence of debris is important. Photomicrographs of scratches on different morphological forms of polyethylene terephthalate film are presented and a mechanism of scratch formation is discussed. Author

N70-38371# RAND Corp., Santa Monica, Calif.
DIAMOND HARDER THAN DIAMOND [ALMAZ TVERZHE ALMAZA]
S. Batsanov Apr. 1970 6 p Transl. into ENGLISH from Pravda (USSR), no. 352, 18 Dec. 1969 p 3
(AD-706415; LT-70-2) Avail: CFSTI CSCL 20/2

A semitechnical discussion is given of the tempering of diamonds using explosions. TAB

N70-38436*# Franklin Inst., Philadelphia, Pa. Research Labs.
EVALUATION OF PYRRONES AS MEMBRANES
H. Scott and F. L. Serafin Washington NASA Sep. 1970 36 p refs
(Contract NAS1-8609)
(NASA-CR-1648; Rept-14G-C2389-01) Avail: CFSTI CSCL 11I

The facile absorption of water by polymidazopyrrolones (Pyrrones) suggested a feasibility study to use films of the polymers as membranes for the purification of water by reverse osmosis. This report describes direct osmosis measurements of water, salt, and urea fluxes through Pyrron membranes. The data indicate comparable flux values and superior water-to-salt permeabilities of the Pyrrones relative to symmetric cellulose acetate membranes. Coupled with better mechanical strength and chemical resistance, these results suggest that the successful fabrication of asymmetric Pyrrone membranes could lead to substantial improvements over asymmetric cellulose acetate, from which the best reverse osmosis membranes are currently prepared. Author

N70-38470# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF STABLE, SPACE REPAIRABLE/REPLACEABLE THERMAL CONTROL COATINGS: SUGGESTED TECHNICAL PROGRAM
J. Brzuskiewicz, K. D. Franson, F. O. Rogers, and J. E. Gilligan 20 Feb. 1970 45 p refs
Avail: CFSTI

A program is suggested for the development of materials and techniques involved in the thermal control of extended lifetime spacecraft. Problems inherent in space replaceable/repairable thermal control systems are discussed. Primary objectives of the program are to identify the basic problems of thermal control in extended duration missions, propose solutions, and to examine critically each solution in terms of its interaction with the properties and performance of the spacecraft system as a whole. Author

N70-38477# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technlogy Div.
THE PROBLEM OF SELECTING LUBRICATING OILS FOR ENGINES WITH VARIOUS LEVELS OF STRESS
V. V. Shchagin et al 17 Apr. 1970 35 p refs Transl. into ENGLISH from Tr. Kaliningr. Tekhn. Inst. Rybnoi Prom. i Khoz. (USSR), no. 19, 1966 p 141-166
(AD-706190; FTD-HT-23-99-70) Avail: CFSTI CSCL 11/8

The selection of the proper quality of lubricating oil for every individual engine type is a decisive factor in the operating reliabilty and potential of engines. In making this selection it must be considered that there exists a different optimal viscosity of oil for every individual engine type, assuring minimum wear under given conditions. Thus, e.g. for low-speed diesel engines the optimal viscosity is 45-70 centistokes at 50 degrees centigrade; for high-speed diesel engines, 75-120 centistokes at 50 degrees centigrade or correspondingly 10-15 centistokes at 100 degrees centigrade; for highly supercharged engines, 20-25 centistokes at 100 degrees centigrade. However, in addition to viscosity, other factors too affect the suitability of various oils: the sulfur content and the thermal stress in the engine. Since pistons and, particularly, the piston rings represent the most thermally stressed regions of the engine, it is logical to classify engines into groups with pistons of similar design liable to similar magnitudes of thermal stress. This thermal stress is conditioned by the heat transfer between the gases and the piston bottom. Author (TAB)

N70-38491# Aberdeen Proving Ground, Md. Coating and Chemical Lab.
VOLATILITY CHARACTERISTICS OF CRANKCASE LUBRICATING OILS USING GAS-LIQUID CHROMATOGRAPHY
George G. Esposito Apr. 1970 18 p ref
(AD-706843; CCL-282) Avail: CFSTI CSCL 11/8

Gas-liquid chromatography was used to obtain the volatility profile of various lubricant base stocks and finished crankcase lubricants. The analysis is made possible through the use of a short chromatographic column in conjunction with high operating temperatures. By comparing the chromatograms from commercial lubricants with those from reference materials, it is possible to catagorize the base lubricant according to volatility. Complete analysis is obtained in approximately 15 minutes. Application to used oils is demonstrated by analyzing samples before and after road testing. Author (TAB)

N70-38546# Gulf General Atomic, San Diego, Calif.
CESIUM SORPTION IN MATERIALS FOR THERMIONIC CONVERTERS, VOLUME 2
M. K. Yates and G. O. Fitzpatrick Apr. 1970 35 p refs
(Contract AT(04-3)-167)
(GA-8574-Vol-2) Avail: CFSTI

Experiments on cesium sorption in materials which serve as high-temperature cesium reservoirs in thermionic converters were conducted. Cesium vapor pressure/sample temperature/ sample loading characteristics were measured for two different types of graphite and one sample of porous tungsten. When the data on the graphite samples were compared to some earlier data, it was found

that the isotherms for different types of graphite were similar; but the transition between two cesium graphite equilibrium states was better defined in some samples than in others. Hysteresis effects were present in most of the graphite samples but appear to pose no particular problems to the thermionic converter. The data concerning the cesium loading in the porous tungsten sample were obscured by soluble cesium compounds present on the inner oven surfaces. It was determined that the primary sorption mechanism was surface adsorption. NSA

N70-38547# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
ABLATIVE CHARACTERISTICS OF POLYETHYLENE AND OTHER THERMOPLASTICS
R. W. Farmer Mar. 1970 40 p refs
(AD-706405; AFML-TR-69-298) Avail: CFSTI CSCL 11/9

The ablative characteristics of polyethylene and four substituted hydrocarbons were examined in arc heated air. The order of increasing penetration rates was polytetrafluoroethylene, a tetrafluoroethylene-hexafluoropropylene copolymer, polychlorotrifluoroethylene, polyethylene, and polyoxymethylene. Penetration rate was related to melting, softening, and viscous flow; molecular structure; sample thickness; secondary reactions; and surface temperature. A polyaminoborane analogy to polyethylene and a tetramethylammonium hydrotriborate derivative of boron hydride underwent penetration at rapid rates. Boron nitride was an efficient conducting heat sink. There was intense, wide-band radiative emission for all three boron-containing, noncharring materials. The major evaluation variables included effluent penetration time, exposure time, heat flux, sample thickness, sample features and surface temperature. Author (TAB)

N70-38558# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF SULFUR-CONTAINING COMPOUNDS WHICH IMPROVE THE ANTICORROSION PROPERTIES OF OILS
A. M. Kuliev et al 15 May 1970 9 p Transl. into ENGLISH from Russian Report
(AD-707179; FTD-HT-23-215-70) Avail: CFSTI CSCL 11/8

By reacting different allyl ethers of phenols with sulfur dichloride and also their subsequent interaction with xanthogenates, a given group of di-sulfides of a given type was obtained. The influence of the synthesized compounds on the anticorrosion properties of diesel oil was studied. It was established that the latter in an amount of 1 percent during tests on a copper plate reduce the corrosion to almost zero. Author (TAB)

N70-38634# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF FRICTION AND LUBRICANTS
M. V. Korovchinskii et al 25 Mar. 1970 18 p refs Transl. into ENGLISH from the Russian
(AD-706645; FTD-HT-23-324-69) Avail: CFSTI CSCL 13/9

Contents: Steady thermal contact; Determining the temperatures at the actual point of contact in the braking process; On the character of wear and destruction of rubber during friction on metallic surfaces under high temperature conditions; Concerning the smearing and seizing of plastic on iron under friction; Friction properties of magnetic tape for computer technology; Problems of actual area and stress conditions of solid body contact; Contact area contour; Elastic deformation and stress at the surface during friction; and The effect of the viscous properties of lubricating materials on the rotating resistance of roller bearings. TAB

N70-38637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTIVE COATINGS ON METALS, NO. 2, 1968
L. P. Ruzinov et al 24 Feb. 1970 121 p refs Transl. into ENGLISH from Zashchitn. Pokrytiya Metallakh (USSR), No. 2, 1968
(AD-706368; FTD-MT-24-21-70) Avail: CFSTI CSCL 11/3

Contents: Chemical thermodynamics of complex deposition of elements on the surface of certain metals; Methods of calculation of constants, characterizing the diffusion processes during oxidation, for cases of heterophase interaction with complex kinetics; Methodology of high-temperature mechanical tests of materials with coatings; Dissusion during high-temperature service of protective coatings on molybdenum; Surface alloying of ZhS6-K alloy with three elements; Heat resistance of alloy ZhS-6K after mulitcomponent diffusion saturation; Score-resistant vacuum diffusion coatings on steels and alloys, used in turbine construction; Thermal diffusion saturation of molybdenum in terms of boron; Cladding of parts in powders and some questions of theory of diffusion saturation; Study of structural features of the diffusion zone and kinetics of deformation of clad steel with a protective chromium-nickel layer; Coating wire with superconducting compound. TAB

N70-38651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAXIMUM PERMISSIBLE LOADS AND SLIP RATES IN METAL-PLASTIC FRICTION PAIRS
Sh. M. Bilik et al 16 Jan. 1970 12 p Transl. into ENGLISH from Primenie Materialov na Osnove Plastmass Dlya Opor Skolzheniya i Uplotnenii v Mashinakh (Moscow), 1968 p 61-65
(AD-706195; FTD-MT-24-355-69) Avail: CFSTI CSCL 11/3

Laboratory test data is given on all-plastics specimen and specimen with a thin layer of plastic to determine permissible combinations of load and slip rates against steel with and without a lubricant. The tests were conducted on a MI-1M friction machine (operated on the principle shaft-partial bearing at slip rates up to 2.0 m/sec., loads up to 80 kg/sq cm and on a disc machine at slip rates up to 10 m/sec., and loads of 100 kg/sq cm. It was shown that out of all materials tested, the heat-resistant polymers - aromatic polyamides with boundary lubrication resulted in the highest permissible service conditions. TAB

N70-38665# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.
ACOUSTIC PROPERTIES OF A POLYMETACARBORANESILOXANE, SEPTEMBER 1968-JULY 1969
Bruce Hartmann and Jacek Jarzynski 2 Mar. 1970 33 p refs
(AD-707319; NOLTR-69-198) Avail: CFSTI CSCL 11/9

Speed of sound and absorption measurements were made on a polymetacarboranesiloxane in the temperature range from -50C to +50C and the frequency range from 92 kHz to 650 kHz. Measurements were also done on isotactic polypropylene to check out the experimental method. For polypropylene at room temperature, the measured speed of sound was 2500 m/sec, in satisfactory agreement with literature values. For the carborane at room temperature, the measured speed of sound was 1400 m/sec, typical for a rubber. Contrary to most polymers (including polypropylene), however, the slope of the sound speed vs. temperature is greater below the glass transition (-20 m/sec/C) than it is above the glass transition (-7 m/sec/C). Author (TAB)

N70-38722# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAMMA RADIATION ON THE PHYSICAL-MECHANICAL PROPERTIES OF CERTAIN NOMETALLIC MATERIALS USED IN BALL BEARINGS
A. G. Baranov et al 4 Feb. 1970 8 p Transl. into ENGLISH from Materialy Nauchn. Prakt. Konf. po Ispolz. Ioniziruyushchikh Izluchenii v Nar. Khoz. (USSR), 1967 p 11-15
(AD-706352; FTD-HT-23-638-69) Avail: CFSTI CSCL 13/9

The strength properties of Textolite, Ftoroplast 4, and AMAN 7 on gamma irradn. are studied. With increasing dose of irradn.

the strength at break and compression decreases. The water permeability of the sample decreases, and the heat stability and oil stability are not changed at doses of 2 times 10 super 8 rads. The Fioroplast 4 samples showed decreased strength at break, and the specific weight of the samples was unchanged. The samples based on AMAN 7 showed good radiation stability, with the strength at break unchanged at doses of 2 times 10 super 8 rads. Strength at break increases somewhat at 5 times 10 super 7 rads, and the specific weight of the samples is not dependent on the irradn. dose. Author (TAB)

N70-38850# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
APPLICATION OF MIE SCATTER THEORY TO THE REFLECTANCE OF PAINT-TYPE COATINGS
R. N. Schmidt, P. M. Truenfels, and E. J. Meehan (Minn. Univ.) [1969] 41 p refs Presented at ASME 4th Symp. on Thermophys. Properties
(Contract AF 33(615)-5035)
(T-223R) Avail: CFSTI

A mathematical model was prepared which predicts the reflectance of coating geometries as a function of the basic optical properties of the materials involved. The model, which was derived strictly from theory with no empirical inputs, computes reflectance as a function of pigment size, size distribution, pigment volume concentration, interface reflectance, surface roughness, indices of refraction of the pigment, binder and substrate, and absorption indices of the pigment, binder and substrate. The model assumes the incident light to be unpolarized, as it is for most practical applications. It is also assumed that the incident light impinges vertically upon the reflective layer, at a single wave-length. It was found that sample sizes of 300 rays are the best compromise between reliability of results on one hand and economic computing time on the other hand. The simulation time was approximately three rays per second on a 7094 computer. Author

N70-38985 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE ON THE PHYSICO-TECHNICAL PROPERTIES OF RUTILE TITANIA OF SURFACE TREATMENT WITH DIFFERENT QUANTITIES OF ALUMINIUM AND SILICON COMPOUNDS [VLIYANIE OBRABOTKI POVERKHNOSTI RUTILNOI DVUOKISI TITANA RAZLICHNYMI KOLICHESTVAMI SOEDINENII ALYUMINIYA I KREMMIYA NA EE FIZIKO-TEKHNICHESKIE SVOISTVA]
T. A. Ermolaeva et al Apr. 1970 9 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (USSR), no. 2, 1969 p 17-20
(NLL-RTS-5660) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

The effect on physico-technical properties of rutile pigment after treatment with large amounts of Al-Si compounds (of the aluminosilicate type) was studied. Relationships have been established between the additive content and the intensity, specific surface area, absorption rate constant, oil capacity, and bulk density of the pigments. It has been shown that 10% Al2O3 and 6% SiO2 rutile retains its covering power as a pigment, and becomes appreciably less photochemically active and more resistant to chalking. When the additive content is raised to 20% Al2O3 and 12% SiO2, the basic physico-technical properties and atmospheric durability of the rutile are impaired. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-37601# Los Alamos Scientific Lab., N.Mex.
EXAMPLE OR ILL-CONDITIONING IN THE NUMERICAL SOLUTION OF SINGULAR PERTURBATION PROBLEMS
Fred W. Dorr May 1970 11 p refs
(Contract W-7405-ENG-36)
(LA-4361) Avail: CFSTI

The use of finite difference methods is considered for solving a singular perturbation problem for a linear ordinary differential equation with an interior turning point. Computational results demonstrate that such problems can lead to very ill-conditioned matrix equations. Author

N70-37616# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ROUNDING-ERROR BOUNDS FOR A RECURSION FORMULA
L. W. Ehrlich Dec. 1969 23 p refs
(Contract NOw-62-0604-c)
(AD-707334; APL-TG-1096) Avail: CFSTI CSCL 12/1

Rounding error bounds are given for the recursion formula: x sub (n+1) = p(x sub n) - x sub (n-1), where p = or < 2. Some statistical bounds are also included. Author (TAB)

N70-37617# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ROOTS OF POLYNOMIALS WITH COMPLEX COEFFICIENTS
L. W. Ehrlich Dec. 1969 23 p refs
(Contract NOw-62-0604-c)
(AD-707332; APL-TG-1099) Avail: CFSTI CSCL 12/1

The companion matrix of the polynomial is formed. The eigenvalues of this matrix are then found by applying the power method, the inverse power method, and matrix deflation to the matrix. Several Newton-Raphson iterations are performed on the polynomials to reduce, as much as possible, roundoff errors in the deflation process. No actual matrix operations are performed, but rather simple formulas are given, taking advantage of the large number of zeros in the companion matrix. The method works well when the polynomial does not have multiple roots or very close roots. Author (TAB)

N70-37618# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RATE OF CONVERGENCE PROOFS OF THE METHOD FOR FINDING ROOTS OF POLYNOMIALS OR EIGENVALUES OF MATRICES BY THE POWER AND INVERSE POWER METHODS
L. W. Ehrlich Dec. 1969 52 p refs
(Contract NOw-62-0604-c)
(AD-707331; APL-TG-1100) Avail: CFSTI CSCL 12/1

Generally known proofs of the convergence of the power method and the inverse power method for finding eigenvalues of a matrix are presented in some detail. The power method is shown to converge geometrically for diagonalizable matrices and proportional to 1/r for nondiagonalizable matrices, where r is the iteration number. The inverse power method is shown to converge at least quadratically for diagonalizable matrices. No rigorous proof of convergence for the inverse power method for nondiagonalizable matrices is given, but several comments are made and an expression for the rate of convergence is presented, along with experimental results. Author (TAB)

N70-37619# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ROUNDING ERRORS IN POLYNOMIAL DEFLATION
L. W. Ehrlich Dec. 1969 24 p refs
(Contract NOw-62-0604-c)

(AD-707330; APL-TG-1098) Avail: CFSTI CSCL 12/1

Polynomial deflation is considered from three viewpoints. It is shown, a la Wilkinson, that the first method requires deflating using the smallest roots (in magnitude), the second method, the largest roots, and the third method, any root. Author (TAB)

N70-37621# California Univ., Berkeley. Space Sciences Lab.
ON POINCARE'S NON-EXISTENCE OF INTEGRALS FOR THE THREE-BODY PROBLEM
Stephen P. Diliberto May 1970 29 p refs *Its* Ser. 11, Issue 41
(Contract N00014-69-A-0200-1024)
(AD-706781) Avail: CFSTI CSCL 3/3

The authors results on difference equations are applied to produce a new type of proof for Poincares non-exstence theorem. The new proof/method avoids cirticisms of all earlier proofs. TAB

N70-37623# RAND Corp., Santa Monica, Calif.
PARTIAL ORDERS OF DIMENSION TWO, INTERVAL ORDERS AND INTERVAL GRAPHS
Fred S. Roberts, Kirby A. Baker (Calif. Univ., Los Angeles) and Peter C. Fishburn (Res. Analysis Corp.) Jun. 1970 47 p refs
(AD-707530; P-4376) Avail: CFSTI CSCL 12/1

The paper has two main purposes. The first is to illustrate the relationship among dimensionality and several other concepts of interest in the theory of binary relations, including weak orders, interval orders, semiorders, interval graphs, comparability graphs, and the breadth of a partial order. The second purpose is to prove several new results and to indicate topics for further research. Author (TAB)

N70-37627# Argonne National Lab., Ill.
C:REGUSE: A LINEAR AND QUADRATIC REGRESSION USER PROGRAM
Conrad E.Thalmayer Feb. 1970 19 p refs
(Contract W-31-109-eng-38)
(ANL-7667) Avail: CFSTI

A user program for the xerox data systems sigma 5 or sigma 7 computer operating under ARGOS (Argonne Operating System) is described. A linear or quadratic weighted least-squares analysis was performed upon not more than 500 data points, yielding the coefficients of the fitted equation, their internal errors, the external errors, and the chi-square value; it uses card input and line-printer output. The significance of the program, its use, and its structure are outlined. The flow charts and listing are included. Author

N70-37634# Notre Dame Univ., Ind. Dept. of Physics.
METHOD FOR THE NUMERICAL INTEGRATION OF OSCILLATORY FUNCTIONS IN TERMS OF EQUALLY SPACED FUNCTIONAL VALUES
A. M. Desiderio [1970] 10 p refs
(Contract AT(11-1)-427)
(COO-427-100) Avail: CFSTI

A method for the evaluation of integrals is based on approximating f(x) by a Lagrange interpolation polynomial. Closed formulas of five and seven points and a five point open ended formula are derived. Author

N70-37635# Argonne National Lab., Ill. Chemistry Div.
C:REGN: A REENTRANT LINEAR AND QUADRATIC REGRESSION ROUTINE
Conrad E. Thalmayer Jan. 1970 27 p refs
(Contract W-31-109-eng-38)
(ANL-7660) Avail: CFSTI

A reentrant, general-purpose routine for the Xerox data systems sigma 5 or sigma 7 computer with floating-point option is described. C:REGN performs a linear or quadratic weighted least-squares analysis, yielding the coefficients of the fitted equation, their internal errors (variances), the external errors, and the chi-square value. The report explains the significance of the routine, describes its use, presents the derivation of all equations employed, and outlines its structure. The flow charts and listing are included. Author

N70-37659# Illinois Univ., Urbana.
UNIVERSAL LOGIC MODULES FOR THE REALIZATION OF ARBITRARY SWITCHING FUNCTIONS. GENERATION OF NEAR-OPTIMAL UNIVERSAL BOOLEAN FUNCTIONS
Franco P. Preparata and David E. Muller 14 Jul. 1969 18 p refs
(Contract DAAB07-67-C-0199; Grants NSF GP-7421; NSF GK-2339)
(PB-188952) Avail: CFSTI CSCL 09E

An easily applied method based on linear algebra is developed for finding universal Boolean functions having a small number of arguments. It is shown that this number is asymptotically minimal. Author (USGRDR)

N70-37664# Pennsylvania State Univ., University Park. Mineral Sciences Experiment Station.
PROBABILITY TABLES FOR LOCATING ELLIPTICAL TARGETS WITH SQUARE, RECTANGULAR, AND HEXAGONAL POINT NETS
Donald A. Singer, and Frans E. Wickman Aug. 1969 100 p refs
(Contract (TA05-1)-918)
(GJO-918-3; MSES-SP-1-69) Avail: CFSTI

Given the size and shape of an existing or hypothetical elliptical target, the probability of locating it can be found. The orientation of the major axis of the target with respect to the grid is considered in two ways: (1) The probability of hitting a target with a specific size, shape and orientation is given for square, rectangular and hexagonal point-nets. (2) The probability of hitting a target having a specific size and shape and random orientation, that is, the orientation is equally likely in any direction, is given for the square and hexagonal point-nets. The mathematical solution is presented first, followed by examples of the use of the tables and then the actual tables. Author

N70-37670# National Materials Advisory Board, Washington, D.C.
TRENDS IN USAGE OF CHROMIUM
May 1970 101 p
(AD-707175; NMAB-256) Avail: CFSTI CSCL 11/6

Contents: Chromium supply (World resources, World production, Government stockpile specifications, Conclusions); Metallurgical applications (Stainless, alloy, and tool steels; Heat- and corrosion-resistant materials, Usage of heat- and corrosion-resistant materials in selected applications, Foundry industry, Nonferrous and special metals, Summary of metallurgical applications); Chemical applications (Applications and normal growth rates, Potential impacts of changing technology, Possible substitutes for chromium chemicals during a national emergency); Refractory applications (Current and future requirements, Supply and availability, National emergency, Summary and recommendations regarding chromite for refractory uses). TAB

N70-37693# Purdue Univ., Lafayette, Ind. Krannert Graduate School of Industrial Administration.
QUADRATIC PROGRAMMING AND ESTIMATION PROBLEMS
E. Loehman, D. Pingry, and A. Whinston 23 Apr. 1970 47 p refs

(Contract DA-31-124-ARO(D)-477)
(AD-706876; AROD-6368-11-M) Avail: CFSTI CSCL 12/2

The purpose of the paper is to present various problems relating to multivariate regression in a unified fashion using the quadratic programming tableau. The topics considered are multicollinearity and the generalized inverse, picking the best regression model, and constrained estimates and hypothesis testing for regression coefficients. TAB

N70-37701# Naval Postgraduate School, Monterey, Calif.
THE DETERMINATION OF THE RANK OF QUADRATIC FORMS USING LINEARLY INDEPENDENT LINEAR RESTRICTIONS ON LINEAR FORMS
John Anthony Dollard (M.S. Thesis) Oct. 1969 45 p refs
(AD-706700) Avail: CFSTI CSCL 12/1

A procedure for determining the rank of a quadratic form was outlined by Cramer and Hald. Additional theoretical verification of this procedure is presented and the results are illustrated with applications in the analysis of variance. Author (TAB)

N70-37712# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NOTES ON DECISION, CONTROL, AND DYNAMICAL SYSTEMS Interim Report
Stanley B. Gershwin, Y. C. Ho, D. H. Jacobson, Milind M. Lele, and K. P. Seshagiri Prabhu May 1970 69 p refs
(Contract N00014-67-A-0298-0006)
(AD-707456; TR-610) Avail: CFSTI CSCL 12/1

Contents: Bounds on minimum time for linear systems; A note on linear quadratic pursuit evasion differential games; A general sufficiency theorem for the second variation; Numerical solutions of an employment model; On the detection of a sudden change in system parameters. TAB

N70-37716# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
TIME OPTIMAL CONTROL FOR A CLASS OF COMMON RANDOM DISTURBANCES
Rufus Oldenburger and Norval P. Smith Jun. 1970 29 p refs
(Contract Nonr-1100(20))
(AD-707455; TR-6) Avail: CFSTI CSCL 12/1

The paper concerns the time optimal control of a system variable where the controlling input is bounded, as is usually the case, and the system is subject to arbitrary disturbances. An arbitrary disturbance is made up of uncontrollable portions followed by controllable sections. In industrial practice controllers are sized, as for example as to power, to fit the system so that the disturbances encountered are primarily made up of uncontrollable sections followed by controllable portions of sufficient duration for the controller to bring the system equilibrium. The control designer wishes to have optimal control for any disturbance made up of such an uncontrollable portion followed by a sufficiently long controllable section. Here this problem is solved with the aid of the maximum principle for the class of second order systems which describe almost all governor-engine applications to first approximation accuracy. Previous attempts to solve the problem involved assuming statistical properties of the disturbance thus severely restricting the class of applications. Here only those statistical properties required to implement optimal control are determined. A single control function is derived which suffices to yield optimal trajectories. Author (TAB)

N70-37768# Michigan Univ., Ann Arbor.
SOME SUFFICIENT CONDITIONS FOR OPTIMALITY IN CONTROL PROBLEMS WITH STATE SPACE CONSTRAINTS
E. G. Gilbert and J. E. Funk (AF Inst. of Tech.) Aug. 1969 12 p refs
(Grant AF-AFOSR-1767-69)
(AD-706388; AFOSR-70-1291TR) Avail: CFSTI CSCL 12/1

The sufficient conditions obtained in the paper are an outgrowth of the work of Mangasarian. As in his paper a chain of inequalities and some ad hoc assumptions lead to a simple and direct proof of the main results. However the hypotheses are weaker, a somewhat different problem is treated, and jumps in the multipliers corresponding to the differential constraints are allowed. The inclusion of the jumps is important for without them it is impossible to prove optimality in almost all optimal control problems where there is a state constraint of the form g(x,t) = or <0. If certain convexity and normality assumptions are imposed in the optimal control problem considered, the sufficient conditions become necessary. The sufficient conditions given here also apply to a number of interesting optimal control problems without state space constraints, including those where sufficient conditions of a similar type have been obtained previously. Author (TAB)

N70-37771# Midwest Research Inst., Kansas City, Mo.
INEQUALITIES FOR GENERALIZED HYPERGEOMETRIC FUNCTIONS
Yudell L. Luke Wright-Patterson AFB, Ohio ARL Mar. 1970 41 p refs
(Contract F33615-69-C-1564)
(AD-706390; ARL-70-0041) Avail: CFSTI CSCL 12/1

It is shown that some well-known Pade approximations for a particular form of the Gaussian hypergeometric function and two of its confluent forms give upper and lower bounds for these functions under suitable restrictions on the parameters and variable. With the aid of the beta and Laplace transforms, two-sided inequalities are derived for the pFq generalized hypergeometric function, p = q or p = q + 1, and for a particular form of Meijers G-function. Several examples are developed. These include upper and lower bounds for certain elementary functions, complete elliptic integrals, the incomplete gamma function, modified Bessel functions and parabolic cylinder functions. Author (TAB)

N70-37773# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
OPTIMAL ALLOCATION OF OBSERVATIONS WHEN COMPARING SEVERAL TREATMENTS WITH A CONTROL 2: 2-SIDED COMPARISONS
Robert E. Bechhofer and Dominique Jean-Marie Nocturne May 1970 29 p refs
(Contracts DA-31-124-ARO(D)-474; Nonr-401(53))
(AD-706373; TR-110) Avail: CFSTI CSCL 12/1

Let P sub 0, P sub 1, ..., P sub p be p+1 normal populations with unknown population means (u sub p) and known population variances. P sub 0 is referred to as the control population and P sub i (1 less than or equal to i less than or equal to p) as the (i)th test population. Based on N sub i independent observations X sub ij (j=1,2,..., N sub i) from P sub i (i=0,1,...,p) where N = the sum over i from 0 to P of N sub i and constants r greater than or equal to 0, d>0 are specified prior to experimentation, it is desired to make an exact confidence statement of the form (1) (mean(x sub 0)-mean(x sub i)-d < u sub 0 - u sub i < mean(x sub 0)-mean (x sub i) + rd (i=1,2,...,p)) where mean(x sub i) is the observed sample mean from P sub i. TAB

N70-37778# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
COMPLEX MATRIX INVERSION VERSUS REAL
L. W. Ehrlich Dec. 1969 27 p refs
(Contract NOw-62-0604-c)
(AD-707329; APL-TG-1097) Avail: CFSTI CSCL 12/1

A comparison is made between n x n complex matrix inversion and the corresponding 2n x 2n real inversion. It is shown that complex inversion is up to twice as fast and error bounds are about half that of the corresponding real inversion. Author (TAB)

N70-37779# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE METHOD OF SPECIAL CHOICE APPLIED TO A MATRIX
L. W. Ehrlich and J. R. Kuttler Nov. 1969 24 p refs
(Contract NOw-62-0604-c)
(AD-707328; APL-TG-1092) Avail: CFSTI CSCL 12/1

The method of Special Choice, a well-known method for finding lower bounds for the eigenvalues of linear operators in a Hilbert space, is applied to a particular matrix problem. The eigenvalues of the finite difference approximation for the vibration of a square clamped plate are bounded below using the eigenvalues of the finite difference approximation for the vibrations of a square simply supported plate, which are known. The results are numerically disappointing, but the idea of the approach may have other applications. Author (TAB)

N70-37789# Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF THE COMPENSATING GYROAZIMUTH
V. P. Demidenko et al *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 5-10 refs (See N70-37787 21-21)
Avail: CFSTI

On the basis of precession theory, the equations of motion of a gyroazimuth [giroazimuta] of the compensating type are considered. A theoretically calculated value is obtained for possible accuracy in a specific example. Author

N70-37795# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE PROBABILITY DISTRIBUTION FUNCTION OF RADIAL ERRORS IN A PLANE
D. N. Davydov *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 45-52 refs (See N70-37787 21-21)
Avail: CFSTI

Probability determination of radial errors in a plane as obtained from measurements of the rectangular coordinates is presented. It is assumed that each of the initial errors of measurement has a normal law of distribution, with a zero of mathematical expectation. A formula for approximate calculation is given, and it leads to a curve of systematic error as a function of the ratio of the axes of equal probability ellipses. Author

N70-37810 Stanford Univ., Calif.
TECHNIQUES FOR COMPUTING OPTIMAL CONTROLS FOR LINEAR SYSTEMS WITH INEQUALITY CONSTRAINTS
Robert Roy Maxfield (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-17442

The basis approach is to consider the problems as problems in nonlinear, in fact quadratic, programming. Solution algorithms are developed to best exploit the special structure of the control problems. The first problem considered is to find a control history to take the system from an initial state to a feasible terminal state in a fixed time, satisfying the state and control constraints, and minimizing a cost function which is quadratic in the state and control vectors. An infinite-time problem is considered to control the system for all time subject to the constraints on state and control but with no terminal constraints. It is shown that the finite-time method can be used to give a method for solution of this problem. An algorithm is developed for finding the bounded control of minimum energy to satisfy the terminal constraints. Dissert. Abstr

N70-37816 Princeton Univ., N.J.
SOME GRAPH PARTITIONING PROBLEMS RELATED TO PROGRAM SEGMENTATION
Brian Wilson Kernighan (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-18168

Graph-partitioning problems derived from the problem of segmentation of programs to minimize page transitions during execution in a paged-memory computer system are considered. In order that the theoretical results may be applied effectively, an attempt has been made to develop algorithms and heuristic procedures for segmentation which are fast, simple, and where possible, relatively stable with respect to inaccuracies in the data upon which they operate. It is proved that subroutine interconnection graphs which satisfy certain cost relationships can be assigned optimally using a rapid algorithm, if duplication of routines is permitted. (The execution time grows linearly with the number of routines in most cases of interest.) This theoretical result is used to point out various hueristic adaptations which would provide good assignments even when the formal mathematical conditions required for optimality are not satisfied. Dissert. Abstr.

N70-37822# RAND Corp., Santa Monica, Calif.
SOME THOUGHTS ON THE USE AND MISUSE OF STATISTICAL INFERENCE
Ralph E. Strauch 12 May 1970 17 p refs Submitted for publication Supersedes P-3992; see N69-20406
(AD-707038; P-3992-1; P-3992) Avail: CFSTI CSCL 12/1

The document contains a discussion of the abuse of techniques of statistical inference resulting from inadequate attention to the relationship between the model used and the real world problem being addressed, and inappropriate interpretation of conclusions in the light of that relationship. The basic principle underlying all statistical inference is that one attempts to distinguish between alternatives by comparing observed behavior with that predicted by predictive models of those alternatives. The use of predictive models which do not describe the behavior of the alternatives between which one wishes to distinguish is a clear violation of that principle. The principle is illustrated in a discussion of sampling from an urn. The technique of causal inference through partial correlation analysis is discussed as an example of the violation of this principle. On the surface this technique appears to have wide applicability in analyses in support of policy studies, but further examination shows its applicability to be somewhere between highly questionable and totally specious. Author (TAB)

N70-37877 IIT Research Inst., Chicago, Ill.
STEADY-STATE SOLUTION OF NONLINEAR NETWORKS
James C. Lambert (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-19696

At the present time there is no general analysis computer code that will perform steady-state analysis of nonlinear networks. A technique utilizing frequency domain convolution and a numerical iterative scheme is proposed which leads directly to such solutions. The proposed technique has the advantage that all spectral components are calculated simultaneously. This result is effected since mathematical operations, especially convolution are performed on entire spectra rather than on individual components of spectra. The use of frequency domain convolution permits the nonlinear characteristics of the elements to be described by polynomials rather than by piece-wise linear approximations. Four example problems are presented which are analyzed by using the methods of convolution. These problems demonstrate the principles and requirements of the method as well as present some of the numerical or computational complications which are encountered. Dissert. Abstr.

N70-37878 IIT Research Inst., Chicago, Ill.
TOPOLOGICAL NETWORK ANALYSIS THROUGH ECONOMIC GENERATION OF TREES AND K-TREES
John Joseph Kulzer (Ph.D. Thesis) 1969 143 p

Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-18614

The classical theory of topological analysis for passive networks, using the Binet-Cauchy expansion of the reduced node-admittance matrix, is presented. The two basic methods to extend this theory to active networks—the Coates-Mayeda two-graph and Chen digraph approaches—are discussed. A brief survey of previous solutions to the tree and k-tree generation problem is presented. Each of these solutions possesses certain shortcomings with respect to speed, complexity, or flexibility when implemented on a digital computer. The theoretical basis for an efficient tree and k-tree generation algorithm is developed. A short computer program implementing this algorithm, is described, and its efficiency is established by comparing the actual execution speed of the program to that of an alternative program, implementing the tree generation method of McIlroy. The two methods, considered above, possess certain similarities, and these, as well as the differences, are discussed in detail. Dissert. Abstr.

N70-37886 Utah Univ., Salt Lake City.
TCHEBYCHEFF APPROXIMATE SOLUTIONS TO NONLINEAR DIFFERENTIAL EQUATIONS
David Edward Olson (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-18681

A method for obtaining approximate solutions to ordinary nonlinear differential equations is developed. The approximate solution is given as a closed-form analytical expression in the independent variable and is expressed as a linear combination of n base functions. For a specified set of n base functions, the approximate solution is optimal in that the error is satisfying the differential equation is minimized in the Tchebycheff or supremum norm sense. The theoretical background for the technique is based on linear Tchebycheff approximation theory. The algorithms presented for the computation of the approximate solution are fixed-point iterative procedures. Sufficient conditions for convergence using the algorithms are developed. A significant application of the developed technique is in obtaining approximate solutions to nonlinear boundary value problems. Using the developed method these boundary value problems are solved with no more difficulty than the initial value problems. Dissert. Asbtr.

N70-37896 IIT Research Inst., Chicago, Ill.
ON THE CLOSED LOOP RESPONSE OF NONLINEAR CONTROL SYSTEMS
William Earl Wedlake (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-18619

A new method, based on the describing function approximations, is proposed for determining the closed loop frequency response of nonlinear control systems. The method applies to multi-values as well as single-valued frequency insensitive nonlinearities and has the advantages of simplicity, possibility of normalization, immediate identification of the regions of jump resonance, adaptability of the method for synthesis purposes, and possibility of checking the behavior of the unforced system without additional steps. The jump phenomena is investigated in detail. Curves for various nonlinearities are presented to show how the input signal amplitude affects the jump phenomena. A method for obtaining the amplitude response of nonlinear control systems is also presented, which uses existing normalized describing function curves and is applicable to systems containing both single-values and multi-valued nonlinearities. Dissert. Abstr.

N70-37900 Michigan Univ., Ann Arbor.
OPTIMAL CONTROL SYSTEMS WITH STOCHASTIC BOUNDARY CONDITIONS
Richard Frederick Baum (Ph.D. Thesis) 1969 252 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-17964

Deterministic problems are considered with a cost functional for which g is continuous but not necessarily class C1, so that the usual necessary conditions do not apply. General criteria are described which insure that a pair is optimal for such problems. Control systems with stochastic fixed initial conditions are motivated and designed. The results for deterministic systems are extended to stochastic systems. The results for an existence theorem are given for systems with linear state equations. Necessary conditions of the Pontryagin type are derived for a given pair to be optimal. Properties of optimal solutions are discussed, in particular the bang-bang principle, for these systems with linear state equations. Various forms of the cost functional (Lagrange, Mayer, Bolza) are discussed, and a sufficiency condition is derived analogous to the Hamilton-Jacobi sufficiency condition. Systems are considered for which B depends upon a random variable. Results are extended to systems with state equations containing a random variable or a stochastic process of a certain type. The applicability of control theory to the modelling of biological systems is considered. Dissert. Abstr.

N70-37903 Washington Univ., Seattle.
THE SLIPPAGE, SELECTION AND DETECTION PROBLEMS
Roger Allen Shorack (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-18315

It is desired to select (in some sense) the best population, or, equivalently, select the true hypothesis. Several approaches to this problem which have been taken by other authors are considered and a new and different dual formulation of the general problem, called the detection formulation, is given. Under this formulation selection rules called DP's (detection procedures) are defined and an intimate connection with the ordinary 2-sample problem is displayed and exploited to obtain a general unified theory. A theory of asymptotic relative efficiency for DP's is also developed and shown to be intimately related to the classical theory of asymptotic relative efficiency for 2-sample tests. Dissert. Abstr.

N70-37904 Polytechnic Inst. of Brooklyn, N.Y.
RECURSIVE OPTIMAL ESTIMATION FOR A CLASS OF NON-GAUSSIAN PROCESSES
Paul Joseph Buxbaum (Ph.D. Thesis) 1969 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-17780

The recursive calculation of the conditional mean estimator for linear discrete time systems driven by non-Gaussian noise is investigated. The approach is to approximate the driving noise density by a sum of Gaussian terms. An exact recursive expression for the conditional mean is then developed. This expression involves terms whose number grows exponentially with the length of the observed sequence. Several approximations to the conditional mean estimate, which require constant computational and storage load, are suggested. These approximations may be considered adaptive filters. Examples of the application of these approximations are given. Retention of a sufficient number of terms results in mean squared errors smaller than those of the optimum linear estimator. When the energy of the driving noise is large in comparison to that of the observation noise, and when the driving noise density is poorly described by a Gaussian function, the difference between the mean squared error performance of our estimates and the optimal linear estimate can be considerable. Dissert. Abstr.

N70-37940# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
OBSERVER THEORY FOR CONTINUOUS-TIME LINEAR SYSTEMS

Edison Tse (Systems Control Inc., Palo Alto, Calif.) and Michael Athans 8 May 1970 48 p refs Submitted for publication
(Grant AF-AFOSR-1724-69)
(AD-706940; AFOSR-70-1486TR) Avail: CFSTI CSCL 12/1

The paper describes the theory of constructing observer-estimators for linear, continuous-time systems. Both deterministic and stochastic cases are considered; in particular, the case that some observations are noise-free while others are noisy is considered. Asymptotic properties for both time-varying and time-invariant systems are analyzed and the influence of observability and detectability assumptions is considered. Author (TAB)

N70-37947# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE CLOSED SETS OF n-VARIABLE BOOLEAN FUNCTIONS Interim Scientific Report
Rocco H. Urbano Nov. 1969 86 p refs
(AD-707490; AFCRL-69-0494) PSRP-398) Avail: CFSTI CSCL 12/1

In the report all of the closed sets of n-variable Boolean functions are obtained. The property of these sets is such that if the variables of any function of a closed set are replaced by variables from (x sub 1, x sub 2, ... x sub n) or by functions of the set, then the function obtained also belongs to the set. Also obtained is a set of non-redundant generators for each closed set. These generators define in essence a collection of building blocks from which networks can be constructed to realize any function from the closed set. Author (TAB)

N70-37971# California Univ., Berkeley. Space Sciences Lab.
PERIODIC SOLUTIONS OF DIFFERENCE EQUATIONS
Stephen P. Diliberto May 1970 33 p refs *Its* Ser. 11, Issue 40
(Contract N00014-69-A-0200-1024)
(AD-706763) Avail: CFSTI CSCL 12/1

The report contains a necessary and sufficient condition for the existence of solutions of certain difference equations and for multiply periodic solutions of linear partial differential equations. These results deal directly with functional properties and thereby avoid the classical difficulty of small divisors stemming from the use of series. Author (TAB)

N70-37992# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
RECOVERY OF INTER-ROW AND INTER-COLUMN INFORMATION IN TWO-WAY DESIGNS
A. M. Kshirsagar 2 Apr. 1970 27 p refs
(Contract N00014-68-A-0515; Proj. Themis)
(AD-706316; THEMIS-SMU-TR-64) Avail: CFSTI CSCL 12/1

The analysis of two-way designs involves (rho sub r) and (rho sub c), the ratios of the inter-row and inter-column variances to the intra variance. These are in general not known and their estimates are substituted. Several estimators with desirable properties are obtained as alternatives to the classical estimates. The effect of their use in the combined inter and intra estimates of treatment effects is studied and the increase in the variance of the estimates of treatment comparisons is obtained. Such designs are useful in practice, as heterogeneity is eliminated in two directions and thereby the precision of treatment estimates is increased. These designs are likely to be of use in the comparison of two or more factors associated with calibrating equipments. Author (TAB)

N70-37996# Oak Ridge National Lab., Tenn.
THE ADJOINT BOLTZMANN EQUATION AND ITS SIMULATION BY MONTE CARLO
D. C. Irving 18 May 1970 35 p refs Sponsored by AEC
(AD-706331; ORNL-TM-2879) Avail: CFSTI CSCL 18/11

The report describes the various forms of the forward and the adjoint Boltzmann equation. Several sections outline the simulation of the forward and adjoint equations by Monte Carlo. The difficulties involved in simulating directly a flux equation are discussed. A final section describes the Monte Carlo solution of the Boltzmann equation for problems involving multiplying media. TAB

N70-38008# Naval Postgraduate School, Monterey, Calif.
TRANSFER FUNCTION ESTIMATION USING THE FAST FOURIER TRANSFORM
Arthur Kislack (M.S. Thesis) Dec. 1969 64 p refs
(AD-706076) Avail: CFSTI CSCL 12/1

A method is proposed for the estimation of the transfer function of a linear, time-invariant system with no numerator dynamics, from random input and output data. The method employed uses the Fast Fourier Transform Algorithm and Least Squares Estimation to obtain the coefficients of the systems transfer function. The procedure has been modeled in FORTRAN IV on an IBM-360 computer. The results of simulation show the feasibility of estimating the order of the transfer function and its coefficients. Author (TAB)

N70-38032# Naval Postgraduate School, Monterey, Calif.
AN EXAMINATION OF THE WALD STOPPING BOUNDS FOR THE SEQUENTIAL PROBABILITY RATIO TEST
Michael William Gavlak (M.S. Thesis) Apr. 1970 96 p refs
(AD-706710) Avail: CFSTI CSCL 12/1

An examination of the Wald stopping bounds for the Sequential Probability Ratio Test (SPRT) is made by comparing results obtained from Monte Carlo simulations of sequential sampling tests with results obtained using Wald formulations. Operating Characteristic, ASN, and V(N) values are presented for test sampling from each of eight Binomial, 14 Exponential, and 24 Normal distributions. An extensive bibliography of references associated with SPRT is included. Author (TAB)

N70-38037# Naval Postgraduate School, Monterey, Calif.
A BRANCH AND BOUND ALGORITHM FOR INTEGER AND MIXED-INTEGER LINEAR PROGRAMS
Joseph Bannon Missal (M.S. Thesis) Oct. 1969 19 p refs
(AD-706698) Avail: CFSTI CSCL 12/2

The algorithm presented is an extension of the Land and Doig branch and bound method combined with the branch selection techniques presented by Beale and Small to solve integer or mixed-integer linear programs. The algorithm obtains the solution by solving a linear program with upper and/or lower bounds on selected branch variables. By systematically changing these bounds, and maintaining only the current canonical form, the solution is assured using a minimum of excess computer storage above that required to solve the linear programming problem. Thus the problem can be solved entirely within the computer core, and the problem converges to the solution faster than most other general integer linear programming algorithms. Author (TAB)

N70-38046# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
INVARIANCE IN LINEAR SYSTEMS
N. H. McClamroch, J. K. Aggarwal (Tex. Univ., Austin), and H. T. Banks (Brown Univ.) May 1970 14 p refs
(Grant AF-AFOSR-814-66)
(AD-706395; AFOSR-70-1285TR) Avail: CFSTI CSCL 12/1

Several authors have considered the problem of invariance in linear systems. Cruz and Perkins have obtained certain necessary and sufficient conditions for one definition of invariance while McClamroch and Aggrwal have obtained other conditions for another definition of invariant systems. In this paper it is shown that these

two concepts are distinct and some of the ramifications of the concepts of invariance are discussed. Author (TAB)

N70-38079# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
FACTORIZATION OF OPERATORS. 3: INITIAL VALUE METHODS FOR LINEAR TWO-POINT BOUNDARY VALUE PROBLEMS
Alex McNabb and Alan Schumitzky Aug. 1969 19 p refs
(Grants NSF GP-7529; NSF GP-8960; NIH GM-16197-01)
(USCEE-371) Avail: Issuing Activity

The two-point boundary value problem is defined and reduced to an equivalent Fredholm equation with a fundamental kernel. The factorization problem for these kernels is studied, the factors and their resolvents are shown to satisfy initial value problems. Returning to the two-point boundary value problem, the factorization formalism is used to obtain equivalent initial value problems. Formal factorization of differential operators and some boundary value problems outside the class defined earlier are also considered. Author

N70-38082 California Univ., Berkeley.
MINIMAL MODELS OF ANALYSIS
James Robert Shilleto (Ph.D. Thesis) 1969 35 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-18970

A discussion is given on the model of second-order arithmetic minimal among those for which two-set-quantifier notions are absolute. Dissert. Abstr.

N70-38100# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
SUFFICIENCY CONDITIONS AND A DUALITY THEORY FOR MATHEMATICAL PROGRAMMING PROBLEMS IN ARBITRARY LINEAR SPACES
Lucien W. Neustadt 1970 28 p refs
(Grants AF-AFOSR-1029-67; NSF GK-15787)
(AD-707576; AFOSR-70-1597TR) Avail: CFSTI CSCL 12/2

The paper is devoted to an investigation of mathematical programming problems in arbitrary linear vector spaces. Two cases are considered: problems with a scalar-valued criterion function, and minimax problems. The constraints of the problem are assumed to be of three types: (a) the point must belong to a given (arbitrary) convex set in the underlying linear space, (b) a finite-dimensional equality constraint must be satisfied, (c) a generalized (possibly infinite-dimensional) inequality constraint, defined in terms of a convex body in a linear topological space, must be satisfied. Assuming that the equality constraints are affine, that the inequality contraints are, in a certain generalized sense, convex, and that the problem is well-posed, Kuhn-Tucker type conditions which are both necessary and sufficient for optimality are obtained. A duality theory for obtaining the multipliers in the generalized Kuhn-Tucker conditions is presented. An application to optimal control theory is also presented. Author (TAB)

N70-38137# IBM Watson Research Center, Yorktown Heights, N.Y.
ON THE ALGEBRAIC COMPLEXITY OF INNER PRODUCT
S. Winograd 10 Dec. 1969 5 p refs
(Contract N00014-69-C-0023)
(AD-706784; RC-2729) Avail: CFSTI CSCL 12/1

The number of binary operations required to compute Summation from i=1 to i=n of (x sub i)(y sub i) is shown to be 2n-1 even when auxiliary functions are used. Author (TAB)

N70-38174# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A CAUCHY SYSTEM FOR THE GREEN'S FUNCTION AND THE SOLUTION OF A TWO POINT BOUNDARY VALUE PROBLEM
R. Huss, H. Kagiwada, R. Kalaba Apr. 1970 18 p refs
(Grants NIH GM-16197-01; NIH GM-16437-01)
(TR-70-17) Avail: Issuing Activity

A parameter in a linear two point boundary value problem is regarded as a new independent variable and the original two point boundary value problem is transformed into a Cauchy system. In particular a Cauchy system for the Green's Function is obtained. It is then shown, conseversely, that the solution of the Cauchy system provides a solution of the original linear two point boundary value problem and the requisite Green's function. Computational results are presented. An alternative approach to Green's functions as the solution of a Cauchy system is provided. Author

N70-38176# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
SOLUTION OF FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNALS THAT SATISFY A LINEAR ORDINARY DIFFERENTIAL EQUATION
S. Azen, H. Kagiwada, and R. Kalaba Sep. 1969 11 p refs
(Grants NSF GF-294; NIH GM-16197-01)
(TR-69-8) Avail: Issuing Activity

A method for reducing Fredholm integral equations with even displacement kernels satisfying a linear ordinary differential equation with constant coefficients to a Cauchy system in which the interval length serves as the independent variable is presented. The Cauchy system is well suited for numerical treatment, and the results of a computational experiment are described. Author

N70-38177# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
EXACT SOLUTION OF A FAMILY OF INTEGRAL EQUATIONS OF ANISOTROPIC SCATTERING
H. Kagiwada and R. Kalaba Sep. 1969 13 p refs
(Grants NSF GF-294; NIH GM-16197-01; NIH GM-16437-01)
(TR-69-10) Avail: Issuing Activity

The solution of a certain Cauchy system that provides the solution of a family of integral equations occuring in the theory of anistropic scattering in a finite slab is presented. Numerical experiments show that the Cauchy system is readily solved numerically, even in the case of very strong forward scattering. Author

N70-38183# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
THEORY OF EXTREMAL CONTROLS FOR LINEAR HEREDITARY PROCESSES
N. H. McClamroch May 1970 25 p refs
(Grant AF-AFOSR-1767-69)
(AD-706387; AFOSR-70-1290TR) Avail: CFSTI CSCL 12/1

A study is made of two classes of very general linear hereditary processes which are subject to controlling actions. Several results, including a representation for solutions of such systems, are presented. Under different hypotheses on the admissible controls the set of attainability is shown to be convex and compact. In each case necessary and sufficient conditions, in the form of a maximum principle, are given in order that a control be extremal. Brief consideration is given to the subject of optimal controls. The special cases of differential-difference equations and integro-differential equations are considered as an application of the general results. Author (TAB)

N70-38188# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING. 16: AN EQUATION INVOLVING

ITERATES
Richard Bellman Jun. 1969 6 p refs
(Grant NSF GP-8460)
(USCEE-368) Avail: Issuing Activity

An attempt is made to find other solutions for a general functional equation having one unique solution. Solutions are investigated using convexitivity, power series convergence, quadratic equations, and differentiation. E.H.W.

N70-38221# Michigan Univ., Ann Arbor. Computer, Information and Control Engineering.
SUFFICIENT CONDITIONS FOR OPTIMAL CONTROL OF A GENERAL CLASS OF LINEAR FUNCTIONAL DIFFERENTIAL EQUATIONS Interim Report
N. H. McClamroch Jan. 1970 18 p refs
(Grant AF-AFOSR-1767-69)
(AD-706384; AFOSR-70-1287TR) Avail: CFSTI CSCL 12/1

Sufficient conditions for the optimal control of linear functional differential equations are presented. The linear process is of a very general type since hereditary effects are allowed in both the state-dependent terms and the control-dependent terms. In addition allowance is made for a general class of terminal conditions which may be specified in function space. Several special cases of the basic result are mentioned. The sufficient conditions are given for the case of differential-difference equations and for integro-differential equations. Reduction of the sufficient conditions to a nonclassical two point boundary value problem is also accomplished. Author (TAB)

N70-38232# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
SPERNER FAMILIES, s-SYSTEMS, AND A THEOREM OF MESHALKIN
Murray Hochberg and Warren M. Hirsch Apr. 1970 19 p refs
(Contract N00014-67-A-0467-0004)
(AD-707387; IMM-381) Avail: CFSTI CSCL 12/1

Our main theorem settles the uniqueness question for maximal s-systems, showing that there is an essentially unique s-system containing M^s elements and characterizing this system. We give also a new proof of Meshalkin's theorem. Author (TAB)

N70-38247# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
EXACT SOLUTION OF PONTRYAGIN'S EQUATIONS OF OPTIMAL CONTROL.1
H. Kagiwada, R. Kalaba, and Y. Thomas Sep. 1969 17 p refs
(Grants NSF GF-294; NIH GM-16197-01)
(TR-69-7) Avail: Issuing Activity

A Cauchy system is derived for a class of optimal control processes. It is then shown that the solution of the Cauchy problem satifies the Pontryagin equations. Author

N70-38248# Utah Univ., Salt Lake City. Dept. of Mathematics.
ON REPRESENTING F^*-ALGEBRAS
R. M. Brooks [1969] 29 p refs Submitted for publication
(Grants NSG GP-8346; NSF GP-18729)
Avail: Issuing Activity

Results of Frechet algebra with identity, their positive functional and Hilbert space representation are presented and the results of the algebras of operators on inner product spaces necessary to prove the representation theorem are obtained. The concept of an enveloping algebra for a Frechet algebra with identity is defined, and it is shown that this concept is realized as the inverse limit of the enveloping algebras of the Banach algebra in an inverse limit, or as an algebra of operators. Author

N70-38301# Utah Univ., Salt Lake City. Dept. of Mathematics.
A RING OF ANALYTIC FUNCTIONS, 2
R. M. Brooks [1969] 19 p refs Submitted for publication
(Grant NSF GP-8346)
Avail: Issuing Activity

A study is presented of the commutative locally convex algebra of all complex-valued functions which are defined and holomorphic in the open unit disc of the complex plane, where the ring multiplication is convolution (the Hadamard product), the other operations are the usual ones, and the topology is the compact-open. Specifically, the spectra of elements of this algebra and the operations of inversion and exponentiation are investigated. Author

N70-38313# Massachusetts Univ., Amherst.
THE FINITE DIFFERENCE-DELAY TECHNIQUE: A NEW APPROACH FOR SOLVING CERTAIN FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS
F. M. Smola and T. J. McAvoy [1969] 45 p refs
(Grant NSF GK-1562)
Avail: Issuing Activity

A computational technique, utilizing a time delay of the dependent variables, is used to solve a class of first order partial differential equations. These equations describe the common chemical engineering process where heat and/or mass transfer takes place between a fluid flowing through a fixed bed of granular solids and the solids. The technique is similar to the standard finite difference technique. It is essentially as fast as the finite difference technique but significantly more accurate. The method is developed for a linear problem and then extended to five similar nonlinear problems. The type of problem where the method should be most useful is one in which the solution contains a dead-time lag. Author

N70-38351# Utah Univ., Salt Lake City. Dept. of Mathematics.
ON ARENS' "WEIERSTRASS PRODUCTS" PAPER
R. M. Brooks [1970] 22 p refs Submitted for publication
(Grant NSF GP-8346)
Avail: Issuing Activity

Arens' generalization of the Weierstrass product theorem for those F-algebras with identity which admit inverse-dense decompositions is considered. The condition of Arens, involving two Banach algebras with identity and a continuous homomorphism from one to the other, is studied for commutative algebras and related to topological properties of their spectra. A theorem is sought which allows a decision on whether or not a commutative F-algebra with identity, A, has an inverse-dense decomposition, given complete information about the spectrum of A as a topological space. The difficulties arising when one tries to remove the last dependence on A from the condition on its spectrum, namely A-convex sets, are considered. A proof of the Arens-Royden theorem for F-algebras is included. P.A.B.

N70-38365# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
EXACT SOLUTION OF A FAMILY OF MATRIX INTEGRAL EQUATIONS FOR MULTIPLY SCATTERED PARTIALLY POLARIZED RADIATION, 1
June Buell, Robert Kalaba, and Sueo Ueno Sep. 1969 8 p refs
(Grants NSF GF-294; NIH GM-16197-01)
(TR-69-1) Issuing Activity

A solution of matrix integral equations for multiply-scattered partially-polarized radiation theory is presented based on previous discussions of a scalar case. Matrix solutions of the nonlinear Cauchy system are shown to be solutions of the Fredholm system. Relationships between the matrix functions are shown. Integrals

approximated by finite sums, using Gaussian quadratures, transform differential integral equations into ordinary differential equation systems with known initial conditions. J.M.

N70-38366# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
EXACT SOLUTION OF A FAMILY OF MATRIX INTEGRAL EQUATIONS FOR MULTIPLY SCATTERED PARTIALLY POLARIZED RADIATION. 2
June Buell, John Casti, Robert Kalaba, and Suao Ueno Sep. 1969 20 p refs
(Grants NSF GF-294; NIH GM-16197; NIH GM-16437-01)
(TR-69-6) Avail: Issuing Activity

A Cauchy system is presented which solves the integral equation for the source matrix in the multiply-scattered, partially-polarized radiation theory. Two auxiliary matrices are used which are functions of an independent variable and one other parameter. The Cauchy system is derived from a family of matrix integral equations. Kernels are presented and a square matrix is introduced as the integral equation solution. The superposition principle for linear systems is used to form integral and differential equations for functions. Differential equations are obtained for matrix functions by differentiation. The initial value method is validated by equation differentiation, substitution, and cancellation. J.M.

N70-38378# Rutgers Univ., New Brunswick, N.J. Dept. of Mathematics.
ANTIPODES THEOREM FOR A-PROPER MAPPINGS AND ITS APPLICATIONS TO MAPPINGS OF THE MODIFIED TYPE (S) OR (S) + AND TO MAPPINGS WITH THE PM-PROPERTY
W. V. Petryshyn [1970] 61 p refs Submitted for publication
(Grant NSF GP-8556)
Avail: Issuing Activity

A pair of real separable Banach spaces with a given admissable projectional scheme are considered. Using a generalized degree theory, a simple proof for the validity of the antipodes theorem for certain A-proper mappings is obtained, and some of its applications are considered. The results are used to study the solvability of nonlinear functional equations involving a class of continuous mappings which are either of the modified types (S) or (S)+ or have the pm-property. Author

N70-38472# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
FACTORIZATION OF OPERATORS. 1: ALGEBRAIC THEORY AND EXAMPLES
Alex McNabb and Alan Schumitzky Jul. 1969 57 p refs
(Grants NSF GP-7529; NSF GP-8960; NIH GM-16197-01)
(USCEE-373) Avail: Issuing Activity

An algebraic theory is presented for the factorization of an invertible element x = r(+) s(-) in a ring R, where the factors r(+), s(-) required to be invertible elements of two complementary subrings R(+), R(-). Formulas for these factors are obtained via two associated Hilbert problems and an imbedding map t of R into a suitably constructed ring S. It is shown, that x is factorizable in R if and only if the imbedded element t(x) is invertible in S. The theory is illustrated by examples which include the triangular factorization of finite and infinite matrices, Volterra factorization of Fredholm operators and Wiener-Hopf factorization of functions and sequences. Author

N70-38475# California Univ., Berkeley.
NEIGHBORHOODS OF HYPERBOLIC SETS
M. Hirsch, J. Palis, C. Pugh, and M. Shub [1970] 28 p refs
(Grant NSF GP-8397)
Avail: Issuing Activity

The asymptotic behavior is outlined of points near a compact hyperbolic set of a C to the r power differomorphism (r > or = to 1) f : M approaches M, where M is a compact manifold. The proof of Smale's Omega-stability theorem (Omega = a set of non-wandering points for f) is completed. Local product structure, fundamental domains, semi-invariant disc families, fundamental neighborhoods, and the proof of the main theorem are presented as well as a pseudo-hyperbolic case and flows. J.M.

N70-38500# Center for Naval Analyses, Arlington, Va.
LEAST SQUARES FITTING OF EXPONENTIAL FUNCTIONS
V. Behrns Mar. 1970 34 p
(Contract N00014-68-A-0091)
(AD-706096; CNA-RC-14) Avail: CFSTI CSCL 12/1

In attempting to fit an exponential function to a set of data points by the method of least squares, the general situation is that the equations resulting from partial differentiation are transcendental in one or more of the parameters and cannot be solved by the usual algebraic methods. This paper develops two methods for dealing with the above difficulty. The first method employs Newtons Formula to fit the general form f(x) = alpha + beta(x to the power a)(e to the power(gamma(x to the power b))). The second method employs numerical analytic methods to fit the form f(x) = alpha + beta(e to the power(gamma x)). Author (TAB)

N70-38507# Hawaii Univ., Honolulu.
LINEAR PROGRAMMING WITH VECTOR-VALUED COST FUNCTION
Rahul Chattopadhyay Apr. 1970 7 p refs
(Contract F44620-69-C-0030; Grant NSF GK-4984; Proj. Themis)
(AD-706117; THEMIS-A70-3; AFOSR-70-1295TR) Avail: CFSTI CSCL 12/2

The report considers a linear programming problem where the cost function is vector-valued. The values of the cost function lies in a partially ordered space. Optimality of strategies has to be defined with this partial ordering in mind. The report explores the relationships among the vortices of the constrained set of policies and the optimal policies. TAB

N70-38508# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.
GRAIN BOUNDARY SEGREGATION OF IMPURITIES IN METALS AND INTERGRANULAR BRITTLE FRACTURE
John R. Low, Jr., Stephen R. Goodman, and Craig L. Smith 1 Mar. 1970 42 p refs
(Contract N00014-67-A-0314-0002)
(AD-706084; CMU-031-727-2) Avail: CFSTI CSCL 11/6

Progress report on two investigations of temper embrittlement in low alloy steels. Part 1 describes the development of a method of examining grain boundary segregation using neutron activation analysis of etching residues obtained from intergranular fracture surfaces. The method is capable of detecting antimony segregation at grain surfaces and of measuring the decrease in antimony with distance from the intergranular surface. Part 2 describes the development of a field ionization atom probe method of analysis applicable to polycrystalline, carbon-free alloys. Processing necessary to produce stable grain sizes of less than 0.5 micron diameter in the alloys of interest is also described. These small, grain sizes are necessary if the probability of finding a grain boundary in the FIM specimen tip is not to be prohibitively low. Author (TAB)

N70-38559# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
HOW GOOD IS THE SIMPLEX ALGORITHM?
Victor Klee and George J. Minty Feb. 1970 30 p refs *Its*

Mathematical Note 643
(Contract N00014-67-A-0103-0003)
(AD-706119; D1-82-0961) Avail: CFSTI CSCL 12/2

By constructing long increasing paths on appropriate convex polytopes, it is shown that the simplex algorithm for linear programs (at least with its most commonly used pivot rule) is not a good algorithm in the sense of J. Edmonds. That is, the number of pivots or iterations that may be required is not majorized by any polynomial function of the two parameters that specify the size of the program.
Author (TAB)

N70-38563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIRECT SEARCH FOR OPTIMAL TRANSIENTS IN OBJECTS WITH ONE CONTROL INPUT
D. A. Avetisyan et al 4 Feb. 1970 20 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 8, 1968 p 75-80
(AD-706180; FTD-HT-23-623-69) Avail: CFSTI CSCL 12/1

The paper represents a new departure in formal mathematical studies on the automated drive in stating that the problem of optimizing transient behaviour in a drive has not as yet been solved anywhere in a way which engineers can put into effect. The present contribution for reasons of space is therefore confined to objects with only one control input, but the proposed approach by the methods of direct search is believed to be generalizable. The essential idea is to concentrate firstly on minimizing the response time, and this can be done heuristically by dynamic programming (Bellman). Other considerations may then be treated as approximate problems, the solutions for which are refined in accord with the optimum response time.
TAB

N70-38575# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
TESTING FOR SERIAL CORRELATION IN LEAST SQUARES REGRESSION. 3
Geoffrey S. Watson and James Durbin (London School of Econ. and Political Sci.) Apr. 1970 43 p refs
(Contract Nonr-4010(09))
(AD-707015; TR-137) Avail: CFSTI CSCL 12/1

Long ago in the desk computer days, the authors suggested, as a test statistic for serial correlation in the errors u of the regression model, y = X(beta)+u d = Summation ((Z sub t) - (Z sub (t-1)))^2/Summation ((Z sub t) - Z bar)^2. Tables of bounding significance points (d sub L) and (d sub U) were provided and a Beta approximation suggested to resolve the inconclusive result, (d sub L)<(d sub obsd.)<(d sub U). A large literature has grown up; other statistics, with distributions not depending on X, and approximate d distributions have been suggested. It is shown here that d has power advantages over its competitors and that, with modern computers, there is no problem in finding the significance points of d - in fact, the original Beta method is quite satisfactory. In an appendix the basic distribution theory of ratios of quadratic forms is given.
Author (TAB)

N70-38582# Eidgenossische Technische Hochschule, Zurich (Switzerland).
STABILIZATION OF OPTIMAL DIFFERENTIAL METHODS FOR NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS [STABILISIERUNG OPTIMALER DIFFERENZENVERFAHREN ZUR NUMERISCHEN INTEGRATION GEWOEHNLICHER DIFFERENTIALGLEICHUNGEN]
Hermann Brunner (Ph.D. Thesis) 1969 86 p refs In GERMAN
(Grant NRC G-A4805)
(Diss-4182) Avail: CFSTI

Considered are properties and solutions of linear differential equations and the stabilization of optimal differential methods for numerical integration of differential equations. It is shown that multistep solutions for classical and modification differential calculation problems differ in their error probability and that step intervals probably are responsible for asymptotic stability behavior.
Transl. by G.G.

N70-38585# Eidgenossische Technische Hochschule, Zurich (Switzerland).
MODIFICATION OF THE EXTENDED HUECKEL THEORY. Ab INITIO CALCULATIONS WITH MINIMUM BASE OF GAUSS AO-FUNCTIONS [MODIFIKATION DER EXTENDED HUECKEL THEORIE Ab-INITIO-RECHNUNGEN MIT MINIMALER BASIS VON GAUSS-AO-FUNKTIONEN]
Harold Frank Baumann (Ph.D. Thesis) 1968 74 p refs In GERMAN
(Diss-4283) Avail: CFSTI

The extended Hueckel theory was modified by omission of the overlap integral and substituion of the Mulliken correlation by another parameterization. Operational efficiency of both methods was compared by evaluating problems in formation energy, voltage, energy, isomer stability, and valence isomerization. Introduction of a suitable minimum basic law for Gauss atom orbitals simplified quantum chemical methods of Clementi and Davis so that they can be applied to organic chemical problems. The Koopman theorems were utilized to calculate ionization potentials of a few selected molecules and results were compared with PE spectra.
Transl. by G.G.

N70-38611# Northwestern Univ., Evanston, Ill.
LINEAR EQUATIONS OVER CONES WITH INTERIORS: A SOLVABILITY THEOREM WITH APPLICATIONS TO MATRIX THEORY
Abraham Berman and Adi Ben-Israel 25 May 1969 13 p refs *Its* Appl. Math. Ser.
(Grants NSF GP-7550; NSF GP-6627)
(Rept-69-1) Avail: Issuing Activity

The solvability of linear equations with solutions in the interior of a closed convex cone is characterized. Corollaries include Lyapunov's theorem characterizing stable matrices and a generalization of Stiemke's theorem of the alternative for complex linear inequalities.
Author

N70-38639# Bell Aerospace Co., Buffalo, N.Y.
ADAPTIVE MODELING AND CONTROL Final Report, 15 Jun. 1965 - 14 Jun. 1970
Frederic D. Powell 12 Jun. 1970 118 p refs
(Contract Nonr-4864(00))
(AD-707104; BA-9500-920183) Avail: CFSTI CSCL 12/1

Properties of and algorithms for a class of linear response-error adaptive modelers and of a class of nonlinear generalized equation error adaptive modelers using quantizers are examined. Adaptive inversion, decorrelation, orthogonalization and normalization are discussed. Control systems operating in two time-scales with preview, and using an adaptive modeler to estimate the state, dynamics, future trajectory, and step-response, etc., of the unknown plant, are developed. The analyses are supported by experimental results.
Author (TAB)

N70-38646# Massachusetts Inst. of Tech., Cambridge.
UNIVERSAL COEFFICIENT THEOREMS FOR K-THEORY
D. W. Anderson [1970] 51 p refs
(Grant NSF GP-8089)
Avail: Issuing Activity

Calculations of the KU and KO homology of various spaces arising from groups are given as applications.
Author

N70-38659# Massachusetts Inst. of Tech., Cambridge.
K-THEORY, SIMPLICIAL COMPLEXES, AND CATEGORIES
D. W. Anderson [1969] 19 p refs

(Grant NSF GP-8089)
Avail: Issuing Activity

The problem of directly constructing spaces which are infinite loop spaces is considered in constructing functors of the form Phi: S.S. approaches the limit S.S., where S.S. is the category of simplicial sets. The functors have the property that X approaches the limit pi sub * Phi(X) is a homology theory, and the simplicial sets Phi(X) are automatically infinite loop spaces. The functors Phi contain most of the well known homology theories, except for bordism theory. R.B.

N70-38681# International Centre for Theoretical Physics, Trieste (Italy).
GROUP THEORY, PART 1: LECTURE NOTES 1 - 7
J. Niederle Nov. 1969 113 p refs Presented at the Intern. Centre for Theoret. Phys. Advanced School of Phys., Trieste, Feb. - Mar. 1969
(IC/69/140) Avail: CFSTI

The basic concepts and theorems of representation theory of finite groups and Lie groups are presented. For simplicity, most of the proofs are omitted and only the core of ideas for understanding current applicatibns of group methods is considered. The meanings of theorems and definitions are explained in detail and illustrated by examples. ESRO

N70-38688 Emory Univ., Atlanta, Ga.
MONOTONE UPPER SEMI-CONTINUOUS DECOMPOSITIONS OF CONTINUA IRREDUCIBLE ABOUT A FINITE SUBSET
Mary Jean Russell (Ph.D. Thesis) 1969 37 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-19615

Continua in a metric space are investigated. Let M be an hereditarily decomposable continuum which is irreducible about a finite subset. Let n be the least integer m such that M is irreducible about a subset containing m points. Then there is a unique set of subcontinua of M such that if H is a finite subset of M, M is irreducible about H if and only if H intersects each of the continua. Moreover, there is a monotone upper semi-continuous decomposition G of M such that no member of G has an interior with respect to M and G is a tree with respect to its elements. If K is a tree with m endpoints and the hereditarily decomposable continuum M is K-like, then M is irreducible about a subset containing m points. Thus the above theorems can be applied to M, although the resulting decomposition space may have fewer than m end elements. Dissert. Abstr.

N70-38696 California Univ., Berkeley.
GENERATION OF GENERALIZED RUNGE-KUTTA INTEGRATION METHODS FOR n-th ORDER SYSTEMS OF p-th ORDER ORDINARY DIFFERENTIAL EQUATIONS
Elon Ryder Close (Ph.D. Thesis) 1969 421 p
Avail: Univ. Microfilms: HC $19.15/Microfilm $5.40 Order No. 69-18900

The generation of schemes for the numerical integration of the initial value problem D(p)x = X * xi, xi(a) = b is presented. Scheme definitions are provided that include the classical Runge-Kutta (RK) and finite difference schemes and, at the same time, are generalizations which provide schemes outside this class. Use is made of the first derivative DX. A global view of the scheme generation problem is provided by developing a formalism that makes use of the concept of differentials. It is shown that all basic results can be obtained from one recursive definition of a generic operator Y and the generic z and y which lie in its domain and range. A constructive means for obtaining specific schemes is developed and an ALGOL 60 program which performs this work is presented. The use of these results is illustrated on a classical example (fourth order RK) and on the simplest class of generalized RK schemes. Dissert. Abstr.

N70-38702# Utah Univ., Salt Lake City.
ON SINGLY-GENERATED LOCALLY M-CONVEX ALGEBRAS
R. M. Brooks [1969] 18 p refs Submitted for publication
(Grant NSF GP-8346)
Avail: Issuing Activity

It is shown that if A is singly-generated a (singly-rationally-generated) commutative, complete locally M-convex algebra with identity and if the type boundary delta sub 2(A) is empty, then A is the direct sum of its radical and an algebra A(D), where D is an open, polynomially convex subset of the plane homeomorphic to the spectrum of A. The problem of constructing an F-algebra from algebras of continuous functions on an ascending sequence of compact subsets of the plane is also considered. Relations are obtained between various conditions on the relationships between the compact sets and their union and the continuity of the functions of the algebra generated. R.B.

N70-38708# Hawaii Univ., Honolulu.
WELL-POSED LINEAR PROGRAMS WITH VECTOR-VALUED COST FUNCTIONS, PART 2
Rahul Chattopadhyay Apr. 1970 6 p refs
(Contract F44620-69-C-0030; Grant NSF GK-4984; Proj. Themis)
(AD-706118; THEMIS-A70-5-Pt-2; AFOSR-70-1294TR-Pt-2)
Avail: CFSTI CSCL 12/2

The note is a continuation of a previous one (AD-706893) on the existence of a solution to linear programs with vector-valued cost-functions. In the note, the assumption of strict normality (i.e., B(O) of the system is relaxed to admit normal systems (i.e., b greater than or equal to 0) TAB

N70-38726 New Mexico State Univ., Albuquerque.
PROPAGATION OF ELECTROMAGNETIC WAVES IN A MEDIUM WHOSE PERMITTIVITY VARIES SINUSOIDALLY IN TIME AND SPACE
Richard Eugene Duren (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-17925

The propagation of electromagnetic waves in a nonconducting charge-free medium, in which permeability is a constant, is investigated. The pump frequency, pump propagation vector, and modulation index are given. The wave equation for TE solutions is obtained. Problems involving semi-infinite media and slabs are also considered. External incidence on a semi-infinite medium is considered for angles that excite both resonant and nonresonant solutions. The case is also considered where total reflection occurs and only evanescent waves are excited in the pumped medium. For internal incidence on the boundary of a semi-infinite medium, both resonant and nonresonant solutions were taken as incident waves. The boundary conditions are applied for both resonant and nonresonant cases. Dissert. Abstr.

N70-38729# Army Behavioral Science Research Lab., Arlington, Va. Behavior and Systems Research Lab.
EVALUTION OF A MULTIPLICATIVE GENERATOR OF PSEUDORANDOM NUMBERS
Frederick W. Kuehl Sep. 1969 29 p refs
(AD-707374; BESRL-TRN-215) Avail: CFSTI CSCL 12/1

The present study reports on the development and testing of a pseudo-random number generator which would be able to rapidly supply the SIMPO-I entity models with numbers meeting essential tests for random qualities. The generator developed by BESRL is a power residue or multiplicative generator, the simplest of the many generators based on the linear congruential method. In addition to an acceptable generator, the work accomplished resulted in a compilation of statistical tests which have wider application for evaluating generators used on other computer systems. The tests are described, and essential mathematical formulations are presented. Author (TAB)

N70-38731# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON THE THEORY AND APPLICATIONS OF DIFFERENTIAL GAMES
1 Oct. 1969 216 p refs Conf. held at Mass. Univ., Amherst, Mass., 29 Sep.–1 Oct. 1969; sponsored by AFOSR
(Grant AF-AFOSR-1768-69)
(AD-707588; AFOSR-70-1552TR) Avail: CFSTI CSCL 12/2

The document contains the proceedings of a conference on differential games held 29 September 1969 to 1 October 1970 at the University of Massachusetts, Amherst, Massachusetts. Over 40 papers are given along with a comprehensive bibliography on the various aspects of differential games. The bibliography together with the papers as well as the final report of the conference roughly represents the state-of-the-art picture of the emerging field of differential games. TAB

N70-38732# Missouri Univ., Columbia. Dept. of Statistics
ISOTONIC REGRESSION WITH APPLICATIONS Final Scientific Report, 1 Jul.–31 Aug. 1969
H. D. Brunk 24 Sep. 1969 5 p
(Grant AF-AFOSR-1691-69)
(AD-707605; AFOSR-70-1715TR) Avail: CFSTI CSCL 12/1

The report is a summary of the chapters to be included in a research monograph to be entitled Statistical Inference Under Order Restrictions with subtitle Theory and Application of Isotonic Regression. The monograph is expected to be published during calendar year 1971. Author (TAB)

N70-38742# Rice Univ., Houston, Tex. Aero-Astronautics Group.
NUMERICAL EXPERIMENTS ON QUADRATICALLY CONVERGENT ALGORITHMS FOR FUNCTION MINIMIZATION
Ho-Yi Huang and Alejandro V. Levy 1969 33 p refs
(Grant AF-AFOSR-828-67)
(AD-707585; AAR-66; AFOSR-70-1610TR) Avail: CFSTI CSCL 12/1

The nine quadratically convergent algorithms for function minimization which appeared in another paper by Huang are tested through several numerical examples. Three quadratic functions and four nonquadratic functions are investigated. For the quadratic functions, the results show that, if high-precision arithmetic together with high accuracy in the one-dimensional search is employed, all the algorithms behave identically: they all produce the same sequence of points and they all lead to the minimal point in the same number of iterations (this number is equal at most to the number of variables). For the nonquadratic functions, the results show that some of the algorithms behave identically and, therefore, any one of them can be considered to be representative of the entire class. The effect of different restarting conditions on the convergence characteristics of the algorithms is studied. Proper restarting conditions for faster convergence are given. Author (TAB)

N70-38762# Stanford Univ., Calif. Electronics Labs.
CANONICAL REPRESENTATIONS OF SECOND ORDER PROCESSES WITH APPLICATIONS
Roger Geesey Jun. 1969 162 p refs
(Contracts AF 49(638)-1517; Nonr-225(83))
(AD-707349; SU-SEL-69-044; TR-7050-17) Avail: CFSTI CSCL 12/1

Contents: Canonical representations of stochastic processes--an introduction; Canonical representations for finite dimensional Markov processes; A general theory for the canonical representation of differentiable processes; Application of the canonical representation to problems in estimation. TAB

N70-38778 Utah Univ., Salt Lake City.
TAME SUBSETS OF 2-SPHERES IN E3
James Welden Cannon (Ph.D. Thesis) 1969 56 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-17915

Characterizations of two classes of tame subsets of 2-spheres in E3 are given which have proven to be especially useful in the study of imbeddings of surfaces in 3-manifolds. A closed subset X of a 2-sphere in E3 is said to be tame if it lies on a tame 2-sphere in E3. The tame set X is said to be a taming set if every 2-sphere S which contains X and is locally tame at each point of S-X is tame. A 2-sphere in E3 together with its interior in E3 is called a crumpled cube. The 2-sphere is called the boundary of the crumpled cube. Suppose that C is a crumpled cube and X is a closed subset of BdC (boundary of C). That (*,X,Int C) is satisfied means roughly that BdC can be side approximated from Int C, missing X. This property measures essentially the one-sided tameness of X. Two characterizations of the sets X are supplied for which (*,X,Int C) is satisfied. Dissert. Abstr.

N70-38781# Helsinki Univ. (Finland).
ON CONSTRUCTING MEASURES FROM MOMENTS
Daniel P. Maki [1969] 9 p refs Submitted for publication
Supported in part by NSF and Hays-Fulbright Res. Grant
Avail: Issuing Activity

The problem of constructing the finite, positive measure sigma is discussed. A description and a method of obtaining sigma are given for certain classes of real sequences. Definitions and notations are shown as well as associated polynomials, orthogonal functions, and meromorphic functions. Theorems and lemmas are developed and proved for moments and singular measures. J.M.

N70-38818# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
BOUNDARY THEORY FOR SUMS OF INDEPENDENT, IDENTICALLY DISTRIBUTED RANDOM VARIABLES
S. A. Molchanov 8 May 1970 15 p Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1, Mat., Mekh. (USSR), v. 24, no. 6, 1969 p 3–10
(Contract NOw-62-0604-c)
(AD-707310; APL-CLB-3-T-621) Avail: CFSTI CSCL 12/1

Martins compact is constructed for sums of multidimensional variables having density in Lebesgue measure. The method is based on the limit theorems for large variances of the Cramer type and on h-transformations of the Markov process. Similar results have been obtained by Ney and Spitzer in the lattice case. Author (TAB)

N70-38851 National Lending Library for Science and Technology, Boston Spa (England).
INTEGRATION IN FUNCTION SPACE AND ITS APPLICATION IN QUANTUM PHYSICS
I. M. Gelfand et al Feb. 1970 58 p refs Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 11, no. 1(67), Jan.–Feb. 1956 Presented at the 3d All Union Conf. on Probability Theory and Appl. (Leningrad), May–Jun. 1965
(NLL-CTO/716-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

Application of the theory of measure and integration in function space to quantum physics is investigated. The historical background of the theory is discussed with respect to Wiener measure and integration and quantum mechanics problems. Selected examples are given for application of the theory to quantum electrodynamics. R.B.

N70-38853# Kentucky Univ., Lexington.
SOME REMARKS ON CONVEX MAPS OF THE UNIT DISK
T. J. Suffridge [1970] 8 p refs

Avail: CFSTI

Let K be the class of functions f(z) = z + a sub 2 z squared + ... which are univalent in the given disk and map the disk onto convex domains. It is shown that if f(z) = z + a sub 2 z squared + ... in E then f is a member of K if and only if Re/F(z,zeta)/ > 1/2 when z and zeta are members of E. The calculated result implies the known results of Strohhaecker and it is also shown that the given sequence preserves subordination of starlike functions. The univalence of given functions is also considered. R.B.

N70-38856# Utah Univ., Salt Lake City.
BOUNDARIES FOR NATURAL SYSTEMS
R. M. Brooks [1969] 22 p refs Submitted for publication
(Grant NSF GP-8346)
Avail: Issuing Activity

The Silov boundary for natural systems and the type 2 boundary for locally m-convex algebras are compared. These boundaries are related to the strong boundary defined for certain natural systems. Results show that for every natural system (X,A) Rickart's boundary S sub r (X,A) is contained in the type 2 boundary S sub 2 (X,A), and that when X is locally compact they agree. It is also shown that if X is also sigma-compact and if A is closed in C (X), then the strong boundary S sub st (X,A) is dense in S sub r (X,A) = S sub 2 (X,A). Examples and theorems are given. Author

N70-38857# Massachusetts Inst. of Tech., Cambridge.
A SPECTRAL SEQUENCE FOR THE HOMOTOPY OF NICE SPACES
A. K. Bousfield and E. B. Curtis [1969] 48 p refs
(Grant NSF GP-8885)
Avail: Issuing Activity

A spectral sequence for computing the homotopy groups of X modulo odd torsion is constructed for each X space. This construction has three advantages over previous methods: it is more generally defined, it has an E sup 1-term suitable for computation, and it has an E sup 2-term which is homologically described for nice spaces. Examples, theorems, and proofs are included. E.H.W.

N70-38880# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
A FEATURE SET FOR CHARACTER RECOGNITION, PART 1
Richard C. Smith, Jr. and Kumpati S. Narendra Sep. 1969 41 p refs
(PR-1) Avail: CFSTI

The feature set consists of 44 real-valued functions of one variable derived from a character, which is considered as a point set in two-dimensional Euclidean space. The features are invariant to a translation of the character and allow decision procedures to be formulated which are insensitive to the size of the character. Qualitative arguments and experimental evidence are given to justify consideration of the feature set. The data is obtained from hand-printed numerics. Author

N70-38915# Naval Research Lab., Washington, D.C.
ON THE DISTRIBUTION OF VALUES OF THE WEIERSTRASS SIGMA-FUNCTION [O RASPREDELENII ZNACHENIY SIGMA-FUNKTSII VEYERSHTRASSA]
A. A. Goldberg 7 May 1970 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mat. (USSR), no. 1, 1966 p 43-46
(AD-706125; NRL-Trans-1205) Avail: CFSTI CSCL 12/1

The standard nomenclature of Nevalinna's theory of the distribution of values is used in the study. The investigation is limited to the case where Im omega sub 1 = 0 and Re omega sub 2 = 0, where the lattice of zeros of the sigma-function is rectangular. An earlier investigation by Selberg showed that for all a not equal to 0 or infinity, m(r,a,sigma) = 0 (ln r) and, consequently, delta (a) = 0. If omega sub 1 = -i omega sub 2, then delta (0) = 0 also. Selberg expressed the conjecture that if /omega sub 2/ is not equal to /omega sub 1/, then zero may be a defective value of the sigma-function. A formula is obtained for the relationship between delta (0) and omega sub 1, omega sub 2, and the validity of Selberg's conjecture is proved. TAB

N70-38916# Hawaii Univ., Honolulu. The Aloha System.
WELL-POSED LINEAR PROBLEMS WITH VECTOR-VALUED COST FUNCTIONS, PART 1 Interim Scientific Report
Rahul Chattopadhyay Apr. 1970 7 p refs
(Contract F44620-69-C-0030; Grant NSF GK-4984; Proj. Themis)
(AD-706893; THEMIS-TR-A70-4; AFOSR-70-1497TR) Avail: CFSTI CSCL 12/2

The present note discusses the problem of existence of a solution to a linear program with a vector valued cost. It is shown that for a strictly normal system, a necessary and sufficient condition for the existence of a solution is that the system B x > 0 x greater than or equal to 0 has a solution. Author (TAB)

N70-38980# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CONSTRUCTION OF NONBINARY CORRECTING ARITHMETIC CODES
V. S. Tereshchenko 6 Apr. 1970 19 p refs Transl. into ENGLISH from Dokl., Vopr. Teorii Elektronnykh Tsifrovykh Matematicheskikh Mashin (Ukrania), no. 3, 1967 p 17-30
(AD-706208; FTD-MT-24-44-70) Avail: CFSTI CSCL 9/4

The possibility is considered of constructing arithmetic error-correcting codes (intended for digital automata) that use number systems with arbitrary base m. Unlike the binary system, in an m-nary system it is not enough to know the position of error; its order and sign should also be determined. An (m-1)-order error is the maximum error in the m-nary system; it may turn 0 into m-1 or vice versa. The number of types of error are tabulated. For detecting and correcting errors of a given order, a code with a lower redundancy than for errors of the order given can be used. The modulo check is used for correcting arithmetic errors in the AN plus B codes, where N = the number to be closed, A and B = constants. Construction of the AN plus B codes that detect and correct single errors is considered. TAB

N70-38986# Rutgers Univ., New Brunswick, N.J.
SUPERHARMONIC FUNCTIONS ON LIPSCHITZ DOMAINS
Martin L. Silverstein and Richard L. Wheeden [1969] 14 p refs Submitted for publication
(Grants NSF GP-14022; NSF GP-8556) Avail: Issuing Activity

Ziomek's recently proven theory of Lipschitz domains is extended to include the more general domain D c E sup n - a bounded open subset of E sup n whose boundary is described locally by a function class of Lip 1. Conformal mapping was used to prove Ziomek's theory. A theorem with two proofs is used to prove D c E sup n is a Lipschitz domain. Proof one shows that the existence of such a limit is a corollary of the existence of a finite fine limit almost everywhere at the Martin boundary of D, and the identification of the boundary with the Euclidean boundary for D Lipschitz. Proof two is the classical Lebesgue point proof. E.H.W.

N70-38989 National Lending Library for Science and Technology, Boston Spa (England).
SPECIAL FEATURES OF THE USE OF LINEAR DISCRIMINANT ANALYSIS IN FORECASTING
M. G. Ter-Mkrtchjan et al 24 Jun. 1970 15 p refs

Transl. into ENGLISH from Tr. Gidromet. Nauch.-Issled. Cent. SSR (Leningrad), no. 44, 1969 p 67–87
(NLL-M-9202-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Linear discriminant analysis is used to statistically forecast meteorological elements from independent material using predictors. Emphasis is placed on methods for selecting the optimum number of predictors. E.H.W.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-37631# Texas Univ., Austin. Atmospheric Science Group.
WIND INTERFERENCE AND THE PLACEMENT OF ANEMOMETERS AND VANES NO OPEN FACED TOWERS
Robert J. Holub (M.S. Thesis) Jan. 1970 57 p refs Sponsored in part by AFIT
(AD-706400; Rept-20) Avail: CFSTI CSCL 4/2

A study of wind interference around an open faced tower having a triangular cross-section 6 feet on each side is presented. This includes the actual collection and analysis of wind speed and direction data around a section of a city of Austin streetlighting (moonlight) tower. Ten sets of Gill microvanes and 3-cup anemometers were employed in the study. The data were analyzed to detect changes in the mean and standard deviation of wind speed and direction observations taken simultaneously at points 3, 6, and 72 feet from the tower section. Although some interference appears to have occurred within 6 feet of the tower, it was not found statistically significant at the 95 percent confidence level. Recommendations concerning placement of wind instruments on Austins moonlight towers are also made. Author (TAB)

N70-37654# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DYNAMICS OF THE STRUCTURE OF THE ATMOSPHERE OVER MOUNTAINOUS TERRAIN FROM 4–70 km AS INFERRED FROM HIGH-ALTITUDE CHAFF, OZONE SENSORS AND SUPERPRESSURE BALLOONS
James E. Lovill Jan. 1970 51 p refs *Its* Atmospheric Sci. Paper No. 160
(Contracts AT(11-1)-1340; DAAG05-69-C-0868)
(COO-1340-20) Avail: CFSTI

Experiments conducted to determine the structure of the atmosphere over the Colorado Rocky Mountains from 4–70 km are reported. Chaff was ejected from gun projectiles at 60–70 km altitude. Superpressure balloons were flown in the mid- and upper-troposphere, and ozone sensors were flown to heights of 37 km. Wave motion appears to be evident in the mesospheric chaff data. A spectral analysis is performed on the components of motion of the chaff to determine primary modes. Wave motion was evident in the superpressure balloon data taken from four ozonesondes released at three-hour intervals. During that twelve-hour period, the ozonesonde data indicated that strong gravity waves were present and that they were nearly stationary. A maximum of ozone at 6 km was seen during the quasi-stationary gravity wave episode. Continuous surface ozone data were obtained at the mountain ozonesonde release site. Maximum ozone concentrations were found in the early morning hours and minimum concentrations in the early afternoon. The possible processes that produce this fluctuation are discussed. Author

N70-37674# Environmental Technical Applications Center (Air Force), Washington, D.C.
A SELECTED ANNOTATED BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES OF IRAQ, JORDAN, LEBANON, AND SYRIA, 1960–1969
Vincent J. Creasi, Dennis L. Boyer, and Alvin L. Smith, Jr. May 1970 36 p refs
(AD-707120; ETAC-TN-70-5) Avail: CFSTI CSCL 4/2

The bibliography contains 112 references to Environmental Studies concerning four Middle East Countries, Iraq, Jordan, Lebanon, and Syria. Approximately 50 items are general references that pertain to one or more of the subject Countries. Sixteen aditional bibliographies of a meteorological and climatological nature are listed. Entries are listed alphabetically by author. A subject index is included for convenience of use. Author (TAB)

N70-37687# Weather Wing (2nd), APO 332, New York.
THE FORECAST SOUNDING PACKAGE
Richard L. Walterscheid 1 Jun. 1970 27 p refs
(AD-707497; Rept-2; WW-TN-70-1) Avail: CFSTI CSCL 4/2

The forecast sounding package is an AFGWC transmitted forecast field of temperature, humidity, and vertical velocity. It has numerous applications in forecasting: severe weather, icing, precipitation, and terminal forecasting of cloud and visibility categories. An appendix describes the AFGWC trajectory model. Author (TAB)

N70-37703# Weather Wing (3rd), Offutt AFB, Nebr. Aerospace Sciences Div.
AEROSPACE SCIENCES: TERMINAL FORECAST VERIFICATION
Ray J. Telfer, Randall C. Webb, and Limon E. Fortner, Jr., ed. Feb. 1970 36 p refs
(AD-707498; Rept-3; WW-TN-70-2) Avail: CFSTI CSCL 4/2

The paper presents philosophical and operational concepts of the 3d Weather Wing TAF Verification System. Discusses the concept of measuring forecasting performance relative to previous performance and the use of the automated forecast verification diagnostic material as a management tool. Author (TAB)

N70-37708# Weather Wing (1st), San Francisco, Calif. 96553.
CEILING AND VISIBILITY ATLAS FOR SOUTHEAST ASIA (1000/2 1/2) Final Report
May 1970 104 p Supersedes Rept-1WW-SS-105-12/1, May 1966
(AD-707496; Rept-1WW-SS-105-12/1) Avail: CFSTI CSCL 4/2

Consists of isoline maps (scale 1:9,000,000) of Southeast Asia showing the distribution of percent frequency of occurrence of ceilings > 1000 ft and visibility > 2 1/2 miles at 0100, 0400, 0700, 1000, 1300, 1600, 1900, and 2200 LST. This publication supersedes the Ceiling/Visibility Atlas for Southeast Asia (1000 and 2 1/2), published by 20th Weather Squadron in April 1966. Author (TAB)

N70-37709# Weather Wing (1st), San Francisco, Calif. 96553.
CEILING AND VISIBILITY ATLAS FOR SOUTHEAST ASIA (5000 AND 5) Final Report
May 1970 104 p Supersedes Rept-1WW-SS-105-12/2, May 1966
(AD-707494; Rept-1WW-SS-105-12/2) Avail: CFSTI CSCL 4/2

Consists of isoline maps (scale 1:9,000,000) of Southeast Asia showing the distribution of percent frequency of occurrence of ceilings = or > 5000 ft and visibility = or > 5 miles at 0100, 0400, 0700, 1000, 1300, 1600, 1900, and 2200 LST. This publication supersedes the Ceiling/Visibility Atlas for Southeast Asia (5000 and 5), published by 20th Weather Squadron in May 1966. Author (TAB)

N70-37747# Air Force Cambridge Research Labs., Bedford, Mass.
SEASONAL AND LATITUDINAL MODELS OF ATMOSPHERIC TEMPERATURE, PRESSURE, AND DENSITY, 25 TO 110 KM
G. V. Groves May 1970 78 p refs *Its* AF Surveys in Geophys. No. 218
(AD-707482; AFCRL-70-0281) Avail: CFSTI CSCL 4/2

The work was undertaken as part of the activities of the Committee on Space Research (COSPAR) panel on a new reference atmosphere, which will aid in the design of aircraft, missiles, and satellites. Based on available observational data, temperature models for the first of each month and for 10 degrees latitude intervals have been developed with values tabulated at 5-km intervals from 25 to 110 km. Pressure and density models have been developed by integration of the temperatures using new 30-km pressure values. Tables of log (pressure) and log (density) are given for the annual mean and for the first of each month. Temperature and density observations are compared with the models.
Author (TAB)

N70-37823# Weather Wing (1st), San Francisco, Calif.
JUNE CLIMATE OF SOUTHEAST ASIA Final Report
Apr. 1970 66 p revised *Its* Spec. Study 105-11/6-Rev
(AD-706887) Avail: CFSTI CSCL 4/2

Deals with the climate of North Vietnam, Republic of Vietnam, Laos, Cambodia, and Thailand for June. Essentially based on previously available data, however, precipitation analyses, ceiling/visibility, and upper air flow are new. Contains brief notes on the climate of Southeast Asia and the geographical features of the Republic of Vietnam, North Vietnam, Cambodia, Laos, and Thailand. Discusses the precipitation, thunderstorms, temperature, relative humidity, surface and upper winds, miscellaneous phenomena and sea operations, contains a station locator and topography map. Isoline analyses (map scale 1:9,000,000) are given for precipitation days, mean, maximum, and minimum precipitation, days with thunderstorm, mean cloudiness, percent frequency of ceiling/visibility greater than or equal to 5000/5 and greater than or equal to 1000/2 1/2 (7 and 16 LST), daily max and min temperatures and mean relative humidity. For selected stations tabular data on fog days, percent frequency visibility less than 1 mile and less than 5 miles (7 and 16 LST) are given also. Mean streamline charts (1:37,500,000) are given for 2000 ft, 850 mb, 700 mb, 500 mb, 300 mb, and 200 mb levels. Also included are charts of mean position of polar front and ICZ (1:17,000,000), typhoon tracks (1:10,000,000), sea surface currents, temperatures, frequency of breakers, sea swell (1:10,000,000). Monthly sunrise, sunset, morning and evening twilight data are presented for Saigon with method for adapting to other stations.
Author (TAB)

N70-37861# Weather Wing (1st), San Francisco, Calif.
OCCURRENCE OF TYPHOONS/TROPICAL STORMS (1949-1969) AT SELECTED LOCATIONS
27 Apr. 1970 52 p *Its* Spec. Study No. 105-55
(AD-706408) Avail: CFSTI CSCL 4/2

WWg Special Study 105-55, Occurrence of Typhoons/Tropical Storms 1949-1969 at Selected Locations, presents the number of typhoons and tropical storms passing within 60, 120, and 240 nautical miles of selected locations in Asia and the Western Pacific.
Author (TAB)

N70-37875# Naval Postgraduate School, Monterey, Calif.
WARM FOG DISPERSAL METHODS AND FOG CHARACTERISTICS AT MONTEREY, CALIFORNIA
Thomas Owens (M.S. Thesis) Oct. 1969 129 p refs
(AD-706738) Avail: CFSTI CSCL 4/2

As a prerequsite to a study of fog dispersal, the literature is surveyed and the various methods of warm fog dispersal are summarized. From an analysis of weather observations during June 1968 - May 1969 at the Naval Auxiliary Landing Field, Monterey, California, it is concluded that the early morning hours of September through November present the highest frequency of fog occurrence and would, therefore, be well suited to fog dispersal field tests. A hand-held, gelatin-coated glassslide method of obtainingfog samples is evaluated in the process of determining the fog droplet distribution in fog and stratus occurring on the Monterey Peninsula. It is found that the distribution is centered about a radius size of 10 microns and in good agreement with current fog models. A series of laboratory experiments using various household detergents as seeding agents are discussed.
Author (TAB)

N70-37882# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 232 15 Jul. 1970 p 6 31 refs (See N70-37880 21-30)
Avail: CFSTI

News items include reports on a method for measuring precipitation quantity from aircraft, an instrument for measuring circulation in a turbulent atmosphere ways to increase radiosonde altitude on ships, the effect of Arctic air on Soviet climate, and the transactions of a on aviation meteorology. Abstracts of 43 scientific articles are presented, including the following: the role of coronal discharge in thunderstorm development, meteorological problems of supersonic aircraft, aerological sounding in and synoptic processes over the southeastern part of the Atlantic, heat content of the Southern Hemisphere oceans, analysis of the cloud cover field over the tropical zone, the correlation between air humidities at different levels, a method for estimating horizontal turbulent diffusion, atmospheric density determination using sodium clouds, rocket measurements of the neutral composition of the upper atmosphere, an urban atmospheric contamination study, determination of sea surface temperature and earth characteristics using satellite measurements, the use of lasers in studying atmospheric diffusion, and the climatology of the earth's radiation balance.
P.A.B.

N70-37887# Air Weather Service, Scott AFB, Ill.
FORECASTING GUSTY SURFACE WINDS IN THE CONTINENTAL UNITED STATES
Andrew W. Waters Jan. 1970 76 p
(AD-706392; AWS-TR-219) Avail: CFSTI CSCL 4/2

The technical report contains case studies of strong surface wind gust occurrences which occur under specific conditions in certain designated areas called Wind Boxes. There are ten such wind boxes within the contiguous United States. Actual cases are included with several of the main weather charts used in forecasting gust occurrences. Procedures shown herein are a relevant part of the method used by the Military Weather Warning Center in forecasting gusty surface winds.
Author (TAB)

N70-38033# RAND Corp., Santa Monica, Calif.
STUDIES IN CLIMATE DYNAMICS FOR ENVIRONMENTAL SECURITY. A NOTE ON THE LATERAL EDDY VISCOSITY DUE TO TRANSIENT ROSSBY WAVES IN A BAROTROPIC OCEAN MODEL
W. Lawrence Gates Apr. 1970 21 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-706707; RM-6210-ARPA) Avail: CFSTI CSCL 4/2

The report describes results of a simulation of a wind-driven homogeneous ocean and its characteristic circulation. From time-dependent numerical solutions of the model, a negative lateral eddy viscosity is estimated in the basin interior, where flow is dominated by transient Rossby waves. These waves produce a systematic meridional convergence of eddy momentum into the latitudes of mean eastward current and are analogous to the Rossby

waves in the general circulation of the atmosphere. This regime exists in spite of the formally prescribed lateral viscosity in the models equations; the required viscous dissipation apparently occurs in the standing waves of the western boundary current system. Results suggest that a strong gradient of the effective eddy viscosity may be characteristic of an ocean with meridional boundaries. This investigation was begun as part of an effort to evaluate the effects of environmental perturbations that could be detrimental to the security and welfare of our nation. Author (TAB)

N70-38131*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SMALL OSCILLATIONS OF A VISCOUS ISOTHERMAL ATMOSPHERE

Robert M. Myers (Ph.D. Thesis—Adelphi Univ.) Aug. 1970 245 p refs

(NASA-TM-X-58051) Avail: CFSTI

The assumptions of small two-dimensional waves in a viscous, compressible, stratified fluid with a constant dynamic viscosity coefficient, mu, leads to a linear system of two second-order, ordinary differential equations in the vertical z coordinate. In solving the viscous problem for small mu > 0 it is found that there is an inviscid region in which the solution behaves like a linear combination of inviscid (mu = 0) solutions. The viscous solution, for those values frequency, sigma, and horizontal wave number, k, which lead to the development of inviscid solutions which are wavelike in z, does not satisfy the radiation condition in the inviscid region since viscosity reflects waves in addition to dampoing wave motion for large z. As mu approaches 0 the ratio of the amplitudes of the incident and reflected waves approaches a limiting value for each fixed z in the inviscid region. Author

N70-38142# Oklahoma State Univ., Stillwater. School of Electrical Engineering.

A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS: WEATHER PHENOMENA Annual Progress Report, 1 Oct. 1968 - 1 Oct. 1969

William L. Hughes, Paul A. McCollum, Arthur M. Breipohl, and Emmett J. Pybus Dec. 1969 186 p refs

(Contract DAAB07-68-C-0083)

(AD-707446; OSU-WP-69-I-8; ECOM-0083-8) Avail: CFSTI CSCL 4/2

The OSU THEMIS Weather Phenomena Project has sampled severe storm sferics at several geographic locations with varied success. The 1969 severe storms were less prevalent than usual in both Oklahoma and New Mexico. The Black Hills, South Dakota area provided an excellent, coordinated series of hailstorms and seeding tests for sferic data gathering. Statistical Pattern Recognition techniques of data reduction have yielded first hints of correlations between sferics and storm patterns with 10 KHz and 50 KHz frequencies being remarkably different from each other. Hail occurrence has been identified as associated with rapid increase in sferic count at frequencies between 50 KHz and 200 KHz although this was not true for all storms. Theoretical studies indicate the aircraft receivers are more discriminating in horizontal polarization than in the vertical by at least one order of magnitude. Details of this study and other topics are contained in this report. Author (TAB)

N70-38179# Florida State Univ., Talahassee. Dept of Meteorology.

ON THE CORRELATION BETWEEN SEVERE WEATHER AND THE TRAJECTORIES OF DEVIATE STORMS OVER THE MIDWEST ON 25 AUGUST 1965

Gary L. Achtemeier Jul. 1969 23 p refs

(Grant ESSA-E22-49-68(G))

(PB-189477; Rept-69-5) Avail: CFSTI CSCL 04B

The results of a case study of two large groups of thunderstorms over eastern Iowa, southeastern Minnesota, southwestern Wisconsin and western Illinois on August 25, 1965 are presented. It was found that nearly all the severe weather reported was associated with 13 deviate storms, i.e., the S-curve and splitting type. It is postulated that mesoscale wind maxima, or meso-jets, with their associated vorticity and moisture transport fields, may have been responsible for the rapid fluctuations in the speed and direction of motion of some of the deviate storms. Author (USGRDR)

N70-38207# Environmental Technical Applications Center (Air Force), Washington, D.C.

US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 1, REVISED: SOUTHEAST ASIA

May 1970 486 p revised Supersedes AD-656092. See N68-10045

(AD-705355; AD-656092) Avail: CFSTI CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in Southeast Asia. Author (TAB)

N70-38215# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 234 7 Aug. 1970 p 5 - 10 refs (See N70-38213 21-30)

Avail: CFSTI

Abstracts of articles and news briefs are reported on cloud brightness parameters, flood prediction in Asian republics of USSR, dissipation of turbulent energy in boundary layers, joint radiothermal and radar measurements of clouds and rain, wave disturbance of the surface layer of the atmosphere by swells, turbulent diffusion in the free atmosphere, a method for measuring the vertical humidity profile, and the atmospheric scattering indicatrix to an altitude of 22 km. R.B.

N70-38240# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

HEATED THERMOPILE ANEMOMETER COMPARED WITH SENSITIVE-CUP ANEMOMETER IN NATURAL AIRFLOW

James D. Bergen 1969 4 p refs

(RM-147) Avail: Issuing Activity

A comparison of twenty 5-minute average speeds which showed discrepancies of as much as + or - 50 percent with windspeeds ranging from 2.8 to 6.6 miles per hour is presented. The magnitude and sense of the deviations did not vary systematically with turbulence intensity or speed. Measurements were made at an air temperature of about 20 C. Author

N70-38298# France. Direction de la Meteorologie Nationale, Paris.

SELECTION OF AGROCLIMATOLOGICAL DATA [RECUEIL DE DONNEES AGROCLIMATOLOGIQUES]

P. Brochet and N. Gerbier May 1970 85 p In FRENCH *Its* Monographie No. 75

Avail: CFSTI

With the aid of accessible climatic data, including temperature, humidity, evaporation, and wind information, statistical data are calcualted of an agroclimatological nature. The methods of estimation, French stations of meteorological research utilized, and time intervals, ranging from 1949 to 1967, for the calculations are discussed. Values for global radiation net radiation, and mean potential evapotraspiration are presented for the months March

through October, in the form of numerical tables and charts. Mean values of the 'alpha' coefficient (corrected Piche formula, applicable to the shelter in woods model) are included. Transl. by P.A.B.

N70-38299# France. Direction de la Meteorologie Nationale, Paris.
CLIMATOLOGY OF THE TONTOUTA AIRFIELD [CLIMATOLOGIE DE L'AERODROME DE LA TONTOUTA]
D. Rignot and M. T. Tanguy May 1970 63 p In FRENCH
/ts Monographie No. 74
Avail: CFSTI

Following a general summary of the geographical and atmospheric conditions of the Tontouta Airfield, New Caledonia, some typical meteorological charts are given. Climatological statistics are then presented for the period 1952 to 1966, in the form of tables with isopleth and isofrequency curves. These tables include information on temperature, insolation, precipitation, evaporation, relative humidity, water vapor pressure, mean pressure distribution, solar wind velocity and direction, wind velocity, visibility, and ceiling. The percentages of temperature measurements in the shade are tabulated at two degree intervals for different local times. Monthly statistics are presented on visibility and ceiling for 1951 to 1960; it is pointed out that very poor visibilities and very low cloud covers are rare. Transl. by P.A.B.

N70-38306# Texas Univ., Austin. Atmospheric Science Group.
MODIFICATION IN SURFACE BOUNDARY LAYER WIND STRUCTURE WITH ONSHORE FLOW
Warren T. Echols May 1970 68 p refs
(Grants NSF GA-367X ; NSF GA-16167)
(Rept-23) Avail: Issuing Activity

The effect of a coastline on the surface boundary layer wind structure was studied using data obtained along the upper Texas coast in June 1968. Two towers, one 90 m from the coast and the other 4.8 km directly inland, were instrumented to make wind speed and direction measurements. Data were obtained up to 27 m for both day and night onshore flow. Estimates of the aerodynamic surface roughness were made at each site yielding a value of approximately 3 cm at the beach tower and 1.5 cm inland. An estimate of the surface roughness parameter was also made for the Gulf using the portion of the profile extending above the internal boundary layer at the beach site. A value near 0.0002 cm was obtained. The height of the internal boundary layer at the beach site was estimated by an observed change in the slope of the wind speed profile. The average height was near 6.7 m. Kinetic energy change inland at different levels was computed between the two sites. Synthesized over-water profiles yielded kinetic energy change from the Gulf to the first inland tower. Lateral and longitudinal intensities of turbulence (gustiness) as well as standard deviations of wind direction were computed at different levels for each site. Author

N70-38321# Air Force Cambridge Research Labs., Bedford, Mass.
ESTIMATED FREQUENCY OF COLD TEMPERATURES OVER THE NORTHERN HEMISPHERE
Henry A. Salmela and Norman Sissenwine Mar. 1970 25 p refs /ts Environ Res. Papers No. 316
(AD-707092; AFCRL-70-0158) Avail: CFSTI CSCL 4/2

Military equipment must be designed to operate at very cold temperatures, at extremes that have a small probability of being attained, perhaps only a few hours a month. The percentage of time during the coldest month that temperatures as cold or colder than -40, -50, -60, and -70F are estimated and mapped for the Northern Hemisphere. Maps of 1, 2, 5, 10 and 20 percent probable low temperatures for the coldest month, based on actual hourly temperature distributions, were available for North America, so that only Greenland and Eurasia needed mapping for completion of the Northern Hemisphere. This was accomplished by developing regression equations which related the departure of the 1,5,10 and 20 percentile lowest hourly temperatures from the monthly mean to the mean daily range of temperature; also, estimates of hourly percentile values of low temperatures were made from available six hour temperature distributions for several stations in Siberia. Author (TAB)

N70-38324# Forsvaret Forskningsanstalt, Stockholm (Sweden).
CALCULATION OF SO-CALLED EFFECTIVE UPPER WINDS IN THE STRATA 0-8 km and 0-14 km [BERAEKNING AV S K EFFEKTIVA HOEJDVINDAR I SKIKTEN 0-8 OCH 0-14 KM]
G. Lindblom Dec. 1969 25 p refs In SWEDISH
(FOA-4-4406) Avail: AEC Depository Libraries

An investigation of the effects of a nuclear attack on Sweden and its environs requires a meteorological base for calculation of the extent of radioactive fallout. This is the first report on 7 years of wind probing at Bromma (ca. 5,300 measurements). Author (NSA)

N70-38358# Tactical Airlift Center, Pope AFB, N.C. Office of Operations Analysis.
WIND ANALYSIS OF CDS TEST DATA
A. R. Manson May 1970 19 p
(AD-708113; TALC-OA-TM-6) Avail: CFSTI CSCL 4/2

In the process of testing the Offset Tracking Device as to its effectiveness in delivering a parachute load to a desired impact point, relative to the effectiveness of the presently used visual method, 80 CDS test drops were made from 600 feet. This wind analysis has two primary objectives: (1) To determine what perturbations (or modifications) of the Doppler wind velocity and direction (as recorded at load exit) would have been at least as effective as the actual wind correction used by the individual navigators. (2) To determine the effect of substituting widely varying wind corrections (perturbations of Doppler wind at altitude) in place of the navigators wind correction, or miss distance from desired impact point. TAB

N70-38369# Singer-General Precision, Inc., Sunnyvale, Calif. Link Div.
IMAGE TRANSFORMATIONS OF SATELLITE CLOUD PHOTOGRAPHY Final Report, 2 May 1968 - 1 Apr. 1970
Robert L. Peters 9 Apr. 1970 94 p refs
(Contract F19628-68-C-0283)
(AD-707609; AFCRL-70-0221) Avail: CFSTI CSCL 4/2

The report describes a study program which was concerned with the investigation of photographic image transformations. Samples of cloud photographs were digitized using a programmable light source (a computer controlled CRT scanner). The digitized data were then processed in various ways and subsequently applied to the CRT scanner system to generate mutated photographic images. The purpose of the transformations was to investigate effects and limits of: (1) variation of luminance levels, in both linear and non-linear fashion, and (2) varying image resolution. Fifty-seven (57) of the recreated photographic prints were selected as those images which best demonstrated the results and goals of this study. These prints, along with the associated pertinent transformation data are included as part of this report. This document is supplied in loose-leaf binder form such that the photographs may be readily removed to facilitate evaluation, comparison, and/or reorganization. Author (TAB)

N70-38391# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
ERRORS ASSOCIATED WITH METEOROLOGICAL DATA ABOVE 30 km
Marvin Kays and E. P. Avara Apr. 1970 44 p refs

(AD-707412; ECOM-5295) Avail: CFSTI CSCL 4/2

Errors in computed wind velocity due only to random errors in position data as determined by the AN/FPS-16 radar were found to vary from approximately 10 mps at 60 km altitude to 2 mps at 30 km. Errors in the computed pressure and density at rocket altitudes can result from uncertainties in the radiosonde height at the 20-mb level. An uncertainty of 0.6 km in the 20-mb height can result in differences of at least eight percent in the pressure and density values above the 20-mb level. Temperature differences of 2.0C at the 20-mb tie-on level (level of radiosonde and rocket data overlap) yield negligible errors (less than 1/2 of 1 percent) in the computed pressure and density values. Author (TAB)

N70-38406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIOMETEOROLOGY, PART 1

D. N. Nasilov 20 Feb. 1970 111 p refs Transl. into ENGLISH from Radiometeorologiya (Moscow), 1966 p 1–150

(AD-706796; FTD-HT-23-1288-68) Avail: CFSTI CSCL 17/9

The book presents in nontechnical form the application of radio and radar methods for studying the atmosphere and predicting weather. The author has assembled extensive experimental data which confirm the connection between radiowave propagation and weather conditions and the structure of the lower atmospheric layers. The second edition has been revised in accordance with the latest data on the effect of the troposphere and ionosphere on the propagation of radiowaves of various bands, and on the propagation of electromagnetic waves in the real atmosphere. Author (TAB)

N70-38441# International Geophysical Year World Data Center A, Washington, D.C. Coordination Office.

GRAVITY, TSUNAMI, SEISMOLOGY, LONGITUDE AND LATITUDE, METEOROLOGY: CATALOGUE OF DATA, 1 July 1957–31 DECEMBER 1969

Mar. 1970 64 p refs

Avail: CFSTI

All the gravity, tsunami, and longitude and latitude data received by WDC-A prior to 31 December 1969 are listed in this catalogue. All the post IGY/IGC meteorological and seismology data received prior to 31 December 1969 are also listed in this catalogue. Author

N70-38454# Environmental Data Service, Silver Spring, Md.

MARKOV CHAIN MODELS FOR PROBABILITIES OF HOT AND COOL DAYS SEQUENCES AND HOT SPELLS IN NEVADA

Clarence M. Sakamoto Mar. 1970 29 p refs

(ESSA-TR-EDS-9) Avail: CFSTI

Markov chain models of the zero, first, and second order are tested to determine their adequacy in estimating probabilities of hot and cool summer day sequences and hot spells at Winnemucca, Nevada. Eight temperature thresholds are used to define a hot day. The selected thresholds are used to determine whether changing the definition of a hot or cool day would affect the fit of the data to the model. It is concluded that the choice of a threshold temperature defining a hot day does affect the utility of Markov chain models. Sequences of hot and cool days, as defined, are not random. The chain model of the first order can be utilized to estimate sequence probabilities of hot and cool days as well as hot spells, provided the appropriate thresholds are selected to define a hot day. Threshold temperatures based on a certain number of degrees above a moving weekly mean maximum temperature is suggested over that involving a specified temperature such as 86, 89 ... F. The advantages of this procedure include better fit to the model and potentially greater versatility to year-round application. Author

N70-38459# Defence Scientific Information Service, Ottawa (Ontario).

RADIATION CHARACTERISTICS OF THE MOST IMPORTANT CLASSES OF LOCAL WEATHER IN THE ARCTIC

G. N. Suzyumova Apr. 1970 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geofiz. (Moscow), no. 4, 1969 p 136–138

(AD-706551; T-537-R) Avail: CFSTI CSCL 4/2

The radiant energy of the sun is of very great importance in shaping local weather. Therefore in the description of climate in terms of classes of weather it is necessary to take into account not only radiation data for considerable intervals of time (for the month or year) but also the day-to-day characterization. For purposes of this study we divided the Arctic Basin (North Polar Sea) into two regions, the first region taking in the polar area down to the 85th parallel, and the second region the eastern part of the Central Arctic Basin adjacent to the Pacific Ocean sector of the Arctic, between 85N and 75N. From the available observations for each class of weather we calculated the mean monthly values of the total and scattered radiations, and determined generalized characteristic values for the three-month period May to July, since within this period the radiation characteristics do not change very much from month to month. Author (TAB)

N70-38528# State Univ. of New York at Albany. Dept. of Atmospheric Science.

ICE FORMATION BY CONTACT NUCLEATION Final Scientific Report

Narayan R. Gokhale Jun. 1970 56 p refs

(Grants NSF GA-328; NSF GA-839)

Avail: Issuing Activity

Different mechanisms responsible for the initiation of ice phase in clouds and corresponding threshold temperatures are studied. Results show that: (1) particle contact at water droplet surface is most effective in nucleation especially if droplets are supercooled. Micron sized silver iodine particles are able to nucleate 100% of supercooled drops in the size range of 100 to 6 microns diameter if a sufficient number of particles contacts droplet surfaces; (2) contact nucleation experiments with freely suspended drops in the wind tunnel agree well with experiments where drops are supported either on a metal plate or on a thermocouple; (3) microcinematic contact nucleation studies indicate that freezing is initiated at contact point on droplet surface and that the surface film freezes before the interior of the drop and (4) best results are obtained by freezing milimeter size water drops in clouds through contact nucleation if silver iodine particles are introduced into the region where the degree of supercooling is at least -5 C. G.G.

N70-38561# State Univ. of New York, Albany. Research Foundation.

STRUCTURE AND MODIFICATION OF CLOUDS AND FOGS Annual Summary Report, 12 Sep. 1968–11 Sep. 1969

Bernard Vonnegut, Duncan C. Blanchard, and Robert A. Cudney Oct. 1969 170 p refs

(Contract F19628-68-C-0057; Proj. THEMIS)

(AD-707507; AFCRL-69-0513; ASR-2) Avail: CFSTI CSCL 4/2

Atmospheric electric experiments in the first kilometer of the atmosphere have demonstrated the feasibility of direct measurement of the potential of the ionosphere. In the laboratory investigations have been completed on inductive charge transfer during particle collisions and on the conditions under which sparks can be produced between clouds of charged particles. Two studies have been carried out on ice nucleation by silver iodide. Dry ice seeding of the clear air has resulted in the production of ice crystal clouds in only 3 percent of the experiments. These findings are discussed. Thousands of drops (of about 4.5 mm diameter) have been freely suspended in the giant vertical wind tunnel and a high

speed camera has been used to study wake interactions. Theoretical work has been carried out on the interaction and growth of raindrops in the upper part of updrafts in thunderstorms. An experimental study has shown it might be possible to account for exponential dropsize distributions in heavy rain on the basis of raindrop breakup. An investigation on the water-to-air transfer of bacteria by jet drops from bursting bubbles has indicated that the jet drops are extremely efficient in skimming bacteria from the surface layer of the water. Author (TAB)

N70-38595# San Jose State Coll., Calif. Dept. of Meteorology.
TETROON DERIVED EDDY VISCOSITY IN THE REGION OF THE ELEVATED WEST COAST TEMPERATURE INVERSION
Robert C. Lile 20 Jul. 1970 39 p refs
(Grant NSF GA-1075)
(SR-1) Avail: Issuing Activity

During the summer of 1967, sixty constant volume balloons (tetroons) were flown within the boundary layer of the San Francisco Bay Region. By ballasting the tetroons to fly at various altitudes, an estimate of the vertical distribution of tetroon-derived Reynolds stress was obtained. Free-lift balloons provided estimates of the vertical wind shear. The averaged vertical distribution of tetroon-derived Reynolds stress (an approximately linear increase with height) indicates a mean vertical convergence of horizontal momentum toward the center of the west coast temperature inversion layer. Typically, a broad wind jet was present with its maximum in the upper central region of the inversion layer. This apparent mean countergradient flux of momentum into the jet suggests the presence of negative eddy viscosity effects above the inversion base. Author

N70-38615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXAMPLES OF THE USEFULNESS OF SATELLITE DATA IN GENERAL ATMOSPHERIC CIRCULATION RESEARCH. PART 1: MONTHLY GLOBAL ATMOSPHERIC CIRCULATION CHARACTERISTICS AS REFLECTED IN TIROS 7 RADIOMETRIC MEASUREMENTS
Lewis J. Allison, Earl R. Kreins (USAF Environ. Tech. Appl. Center), Frederic A. Godshall (ESSA), and Guenter Warnecke Washington Dec. 1969 116 p refs
(NASA-TN-D-5630; G-959) Avail: CFSTI CSCL 04B

A climatological analysis was made of TIROS 7-8-12 micron radiation data for the period June 19, 1963, through December 31, 1964. Patterns in TIROS 7 quasi-global maps of monthly mean equivalent black-body temperatures in the window region appear to be well related to conventional cloud cover observations, the major Northern Hemisphere ridge-trough positions, the seasonal movement of the intertropical zone convergence, and large-scale monsoonal circulation patterns over India and southeast Asia. Author

N70-38624# Israel Program for Scientific Translations, Ltd., Jerusalem.
OASES IN ANTARCTICA [OAZISY V ANTARKTIDE]
A. V. Solopov 1969 152 p refs Transl. into ENGLISH from Meteorol.: Sbornik Statei (USSR), No. 14, 1967 p 1-143
Prepared for NSF /ts Meteorology No. 14
(TT-6850490) Copyright. Avail: CFSTI CSCL 08H

Contents: current conceptions of Antarctic oases; principal climate-forming factors; (underlying surface); peculiarities of the radiation and thermal balance; atmospheric circulation over regions of oases at the east coast of Antarctica; meteorologic conditions; aerological characteristics of the boundary layer and the free atmosphere; meteorological regime. USGRDR

N70-38652# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
ON THE FUNCTION OF HYDROCARBON AND NITROGEN OXIDES IN PHOTOCHEMICAL-SMOG FORMATION
Basil Dimitriades Sep. 1970 41 p refs
(BM-RI-7433) Avail: Issuing Activity

The roles of hydrocarbons and nitrogen oxides in smog formation were investigated. Samples of automobile exhaust with varying HC and NO sub x levels were irradiated in a smog chamber under conditions that resulted in smog levels similar to those observed in the atmosphere. Results were used to define the patterns that describe the dependence of a number of smog manifestations on HC and on NO sub x. Using these dependence data and some simplifying assumptions, estimates were made of the ranges within which HC and NO sub x must lie in order to obtain specified levels of air quality. Author

N70-38677 National Lending Library for Science and Technology, Boston Spa (England).
AFRICAN CLIMATOLOGY: POSSIBILITIES OF SHORT, MEDIUM AND LONG TERM FORECASTING
G. Damiean 28 Nov. 1969 19 p Transl. into ENGLISH from Terres Eaux (Paris), Apr.-Jun. 1969 p 21-30
(NLL-M-9048-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Cumulative curves of precipitation were used as a basis for short and medium range forecasting in Africa. The curves provide a basis for checking former data, and provide compensatory processes of comparatively high frequency which permit forecasts of future amounts of rain in agreement with the general rainfall trend. Limnimetric data of African lakes are discussed as a means of studying climatic variations and providing long-term forecasts. R.B.

N70-38703# Environmental Science Services Administration, Washington, D.C.
THE FEDERAL PLAN FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH, FISCAL YEAR 1971
[1970] 72 p refs
Avail: CFSTI

The plan describes some significant events during 1969 and discusses Federal activities in meteorology. A summary of fiscal data and basic and specialized meteorological services are presented with respect to operations, along with supporting research programs designed to improve the individual service. The operational and supporting research programs are treated separately in terms of the meteorological functions performed. The operation of the various meteorological satellites is discussed. Author

N70-38725 Rice Univ., Houston, Tex.
THUNDER
Arthur Allen Few, Jr. (Ph.D. Thesis) 1969 316 p
Avail: Univ. Microfilms: HC $14.40/Microfilm $3.00 Order No. 69-19286

The generation, propagation, and dissipation of thunder is examined in detail. A theoretical model for the sound wave produced by the explosive cylindrical shock wave resulting from the lightning flash is described, and the acoustic power spectrum that is produced by this theoretical sound wave is compared with the observed thunder power spectrum. An experiment is described that uses an array of microphones to record the thunder signal for detailed analysis on a digital computer, and one of the thunder records is analyzed in detail. The physical properties that determine the propagation and attenuation of sound in the earth's lower (0-90km) atmosphere are discussed, and a simple maximum amplitude model for the vertical propagation of thunder is proposed. Using this model and the acoustic power spectrum of thunder, the proposition of a thunder-ionosphere interaction is examined. The results show that even in the maximum amplitude case very little of the acoustic thunder energy will reach the ionosphere; most of the energy is dissipated at a height of 50 km. Dissert. Abstr.

N70-38738# Saclant ASW Research Center, La Spezia (Italy).
METEOROLOGICAL DATA OF THE MILOC-BALTIC 1967 CRUISE
R. Pesaresi 15 Oct. 1968 51 p refs
(Saclantcen-TR-125) Avail: CFSTI

The meteorological observations taken during a multiship oceanographic survey conducted in the Baltic Sea in June 1967 are reported. Derived calculations of the fluxes of momentum, sensible and latent heat, and the solar radiation are also given. Author (ESRO)

N70-38816# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 1: AREA 1 ARGENTINA, AREA 2 - BERMUDA, AREA 3 - GUANTANAMO
May 1970 483 p
(AD-706357) Avail: CFSTI CSCL 4/2

The data contained in these tables were obtained from tape data Family II (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. Author (TAB)

N70-38835 National Lending Library for Science and Technology, Boston Spa (England)
NUMERICAL EXPERIMENTS ON THE MODIFICATION OF THE KINETICS OF CLOUD SPECTRUM FORMATION BY THE INTRODUCTION OF ADDITIONAL CONDENSATION NUCLEI
Ju. S. Sedunov 8 Apr. 1970 8 p refs Transl. into ENGLISH from Tr. Inst. Eksperim. Meteorol. (Moscow), no. 6, 1969 p 3 - 9
(NLL-M-9083-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Analyzed are the effects of introduced surface-active substances on condensation nuclei in clouds during weather modification. An equation for the initial stage of condensation and droplet formation is obtained by varying the parameters of concentration and artificial nuclei size that can be extended to give a distribution of supersaturation in time allowing for the formation of additional nuclei as the air cools. It is found that the efficiency of additional nuclei depends on their activity in droplet formation when maximum supersaturation is reached. G.B.

N70-38839 National Lending Library for Science and Technology, Boston Spa (England).
PRECIPITATION MEASUREMENTS
J. Sandsborg 24 Jun. 1970 25 p refs Transl. into ENGLISH from Inst. Lantbruk. Hydrotek., Grund Forbattring (Uppsala), no. 21, 1968 p 133 - 149
(NLL-M-9182-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupon

Considered are rain gauge measurement errors caused by wind effects and the proper positioning of the gauge orifice to eliminate disturbances. By placing the orifice of the gauge on a level with the surface of the ground or of the vegetation, errors can be considerably reduced. The orifice should have the same slope as the underlying surface when precipitation is measured on a slope since it is not possible to calculate precipitation from measurements with a gauge set up on a sloping surface, unless the angle of incidence of the precipitation particle and the inclination and orientation of the slope are known. G.G.

N70-38840 National Lending Library for Science and Technology, Boston Spa (England).
PARAMETERS OF THE ZONAL ATMOSPHERIC CIRCULATION IN THE NORTHERN AND SOUTHERN HEMISPHERES USING DATA FOR 1966 - 1967
A. P. Bojko et al 24 Jun. 1970 6 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), v. 31, 1968 p 43 - 47
(NLL-M-9209-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The atmospheric circulation indexes (the angular velocity of air relative to the angular velocity of the earth) are tabulated for the 500 mb surface for the northern and southern hemispheres. Seasonal climatic values of the index for the 700 mb surface are included. F.O.S.

N70-38841 National Lending Library for Science and Technology, Boston Spa (England).
A TECHNIQUE FOR INDIRECT CALCULATION OF THE DURATION OF PRECIPITATION
I. A. Aframeeva 9 Apr. 1970 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 247, 1969 p 76 - 81
(NLL-M-9104-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The duration of precipitation in Western Europe was investigated to develop the numerical characteristics for forecasting the duration of precipitation. The equation $S = n/N \times r$, where S is the total duration of precipitation in hours; n is the number of days on which precipitation was recorded; r is the number of hours in the month; and N is the total number of observed precipitation occurrences during the month, was used to calculate the duration of precipitation. Comparisons of the results calculated by using this equation showed that the calculations were 10 to 15% too high. F.O.S.

N70-38864 National Lending Library for Science and Technology, Boston Spa (England).
DISTRIBUTION OF AIR DENSITY OVER THE PACIFIC
K. T. Logvinov 24 Jun. 1970 7 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Aeroklim. (Moscow), no. 47, 1969 p 28 - 32
(NLL-M-9225(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Information is given on the air density characteristics calculated from rocket and radiosonde measurements of temperature and air pressure made on board ships from 1957 to 1963. Separate values of the air density were calculated on a computer, for standard heights at invertals of 1 km, from air density were calculated on a computer, for standard heights at intervals of 1 km, from air temperature and pressure measurements for each rocket (radiosonde) ascent. The following longterm characteristics were calculated for the heights: seasonal mean, annual means and minimum and maximum air density, and the root-mean-square departures of the density for the year. The grouping and processing of the data were done in 20 degree latitudinal zones. The distribution of the density characteristics for the stratosphere was obtained from rocket measurements and for the troposphere from radiosonde observations, made at intervals of approximately six hours from the moment of launching. Author

N70-38904# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
RADAR CHARACTERISTICS OF THE MELTING LAYER: A THEORETICAL STUDY
B. E. Ekpenyong and R. C. Srivastava 12 Feb. 1970 46 p refs Sponsored in part by United Airlines Found. Prepared in cooperation with IIT Res. Inst., Chicago
(Grant NSF GA-10639)
(TR-16) Avail: Issuing Activity

The radar characteristics of the melting region associated with steady stratiform precipitation are calculated under certain simplifying assumptions. It is assumed that the temperature

distribution within the melting region does not vary with time, a steady flux of snowflakes of prescribed size distribution is maintained at the OC level, and there is no breakup or aggregation of snowflakes. For the purposes of calculating the fall speed, rate of melting, and radar back scattering cross section, it is assumed that the snowflakes may be regarded as spherical and that the melted water forms a coat around the snowflake. These assumptions yield the density of the snowflake as a function of its mass. A nomogram Figure 4 is given for computing the fall speed and the fraction of the mass of a melted snowflake as a function of its mass and distance fallen. The radar reflectivity, the Doppler power spectrum, and its mean and variance are computed as a function of height in the melting region. The computed Doppler spectrum is found to be bimodal at certain heights in the melting region. A comparison with observations suggests that aggregation and breakup of snowflakes probably do occur, and the lapse rate of temperature is steeper in the lower portions of the melting region. Author

N70-38908 Florida State Univ., Tallahassee.
ON THE SCALE OF ATMOSPHERIC MOTIONS WITHIN MIDDLE-TROPOSPHERIC FRONTAL ZONES
Melvyn A. Shapiro (Ph.D. Thesis) 1969 221 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-17684

By means of laborious subjective calculations and individual case studies, synoptic meteorologists have demonstrated the importance of intense vertical motions associated with middle-tropospheric frontal zones. This study presents an attempt at utilizing current numerical techniques to produce detailed frontal-scale vertical motions comparable to these subjective calculations. It is shown that intense baroclinic processes within intense middle-tropospheric frontal zones are an essential ingredient in cyclogenesis. Therefore, numerical weather prediction models must include processes on this scale for adequate prediction of cylogenesis. Conventional radiosonde data are shown to contain adequate information to resolve frontal-scale processes but at present only through laborious subjective analysis. Dissert. Abstr.

N70-38922 National Lending Library for Science and Technology, Boston Spa (England).
PROBLEMS IN THE CIRCULATION OF OZONE IN THE EARTH'S ATMOSPHERE
A. H. Hrgian 8 Mar. 1970 25 p refs Transl. into ENGLISH from Russian journal
(NLL-M-7937-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The change in the concentration of ozone due to the general circulation of the atmosphere and the vertical movement of air is examined. It is shown that as a result of meridian circulation, ozone is accumulated in the polar regions and its concentration decreases in the tropical latitude. Calculations show that in the case of ascending movements the level of the maximum concentration levels of ozone rises while the total concentration of ozone significantly decreases. In the case of descending movement the lowering of the level of the maximum concentration of ozone and especially the increase in the total amount of ozone are not evident. An analysis is made of the vertical distribution of ozone when only macro-turbulent intermixing takes place. It is found that macro-turbulent exchange does not lead to extensive redistribution of ozone along the vertical line and has little effect on its total concentration. Author

N70-38946 National Lending Library for Science and Technology, Boston Spa (England).
THE MAXIMUM MIXING DEPTH OVER BUDAPEST
M. Gubola 24 Jun. 1970 9 p refs Transl. into ENGLISH from Magy. Met. Tars. Foly. Idoj. (Hungary), no. 73, 1969 p 229–234
(NLL-M-9207-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The average and maximum depth and frequency of the mixing layer at five different density sites over Budapest were studied during the period October 1964 to September 1968. The conditions for dilution are most favorable in the afternoon because the thickness of the mixing layer is at a maximum. The studies show that morning mixing thickness levels are very small throughout the year and large pollution concentrations are possible. Afternoon thickness levels favorable to mixing vary between 34 and 41% and those unfavorable between 12 and 24%. The morning thickness levels are 73 to 100% unfavorable for turbulent diffusion of effluents. R.B.

N70-38947 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PLANNING OF A NETWORK OF CLIMATOLOGICAL STATIONS
L. S. Gandin 8 Apr. 1970 30 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 228, 1968 p 5–29
(NLL-M-9065-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Information about the statistical structure of meteorological fields is used to estimate the mean error in values of meteorological elements in planning a station network. The greater the error, the greater the loss due to inadequate knowledge of meteorological conditions. Since the knowledge of the optimum network density corresponding to the minimum sum of expenditure and losses is insufficient, the economic problem is replaced by the problem of rational arrangement of the network. Based on research on observation errors and variations in data, a long-term plan for development of a meteorological network and estimation of maximum permissible distances between stations is worked out. R.B.

N70-38948 National Lending Library for Science and Technology, Boston Spa (England).
PATHS OF DEPRESSIONS AND ANTICYCLONES AT SEA LEVEL IN THE NORTHERN HEMISPHERE
A. P. Kryzanovskaja 24 Jun. 1970 17 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), v. 26, 1969 p 79–91
(NLL-M-9208(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Synoptic and statistical procedures were used to obtain the main paths of pressure systems by averaging single paths. Separate charts of the frequencies of mobile depressions and anticyclones, which indicate the most frequent paths and the regions in which barometric disturbances become stationary, were drawn. The frequencies of depressions and anticyclones at sea level in the Northern Hemisphere were determined by counting on monthly charts the paths of the centers of all moving and slow-moving deep pressure systems over a period of five years. Based on the data for frequencies, four charts were drawn for each kind of pressure system and superimposed on the composite monthly mean charts of paths. The position of the main path of pressure systems in a particular region of the hemisphere is then determined. R.B.

N70-38957 National Lending Library for Science and Technology, Boston Spa (England).
VARIATIONS OF ATMOSPHERIC CIRCULATION AND CLIMATE IN THE TWENTIETH CENTURY
S. S. Savina et al 9 Apr. 1970 14 p Transl. into ENGLISH from Priroda (Moscow), no. 2, 1969 p 38–46
(NLL-M-9103-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The importance of variations of climate and weather are

reviewed in relation to their effects on human activity in all spheres of life. Fluctuations are of particular scientific and practical interest and were established by instrumental observations, and subsequently analyzed for quantitative estimates. Determinations were based on the interaction of 3 basic factors: flux of solar radiation, character of the underlying surface, and circulation of the atmosphere. It was established that the circulation of the atmosphere is the most dynamic factor. The long term and annual variations of the dynamics of atmospheric circulation are used to determine the character of climatic trends during the 20th century. E.M.C.

N70-38959 National Lending Library for Science and Technology, Boston Spa (England).

STATISTICAL EXAMINATION OF THE REUSSTAL FOEHN BY R. WIDMER

Jurgen Pelz 24 Jun. 1970 8 p refs Transl. into ENGLISH from German report, 1968

(NLL-M-9184-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A method for forecasting the beginning and termination of a foehn is investigated for Altdorf in Reusstal, north of the St. Gotthard pass. The stations Locarno and Zurich were chosen as reference points, since a 5 mb difference in pressure between the two stations usually accompanies a foehn. The selected meteorological parameters for various altitudes are listed. The forecast of the foehn is made primarily on the basis of the predicted pressure difference between the northern and southern sides of the Alps. F.O.S.

N70-38964 National Lending Library for Science and Technology, Boston Spa (England).

ON THE RELATION BETWEEN SOLAR ACTIVITY AND THE TEMPERATURE REGIME OF THE NORTHERN HEMISPHERE

A. I. Ol 24 Jun. 1970 6 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 30, 1969 p 108 - 109

(NLL-M-9187-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A review of methodology used to establish a relationship between variations of temperature anomalies and solar activity is presented. Specific reference is made to a method in which the relationship is based on a comparison with Wolf number cures. The inadequacy of this method is demonstrated and it it concluded that there are no grounds for the categorical denial of any relation between solar activity and the character of the temperature regime simply because the geophysical phenomenon is not related to Wolf numbers. D.L.G.

N70-38977 National Lending Library for Science and Technology, Boston Spa (England).

A COMPARISON OF MEASUREMENTS OF WATER CONTENTS OF CUMULUS CLOUDS MADE BY WATER CONTENT INSTRUMENTS AND BY CLOUD DROPLET SAMPLERS

N. A. Gusak et al 9 Apr. 1970 9 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Met. (Moscow), v. 6, 1969 p 137 - 141

(NLL-M-9100-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Compared are results of synchronous measurements on water contents of cumulus clouds made with water content instruments and with droplet samplers. It is shown that both instruments give qualitatively the same variation of water content in a cloud along an aircraft's path. Water contents measured with the water content meter were of the same order of magnitude as those calculated from droplet sampler data. Author

N70-38981 National Lending Library for Science and Technology, Boston Spa (England).

DIURNAL VARIATION OF UPPER WINDS IN THE TROPICS

K.-D. Lange 24 Jun. 1970 11 p refs Transl. into ENGLISH from Inst. Met. Geoph. Met. Abh. (West Germany), v. 92, no. 12, 1969 12 p Presented at Meteorol. and Geophys. Seminar, Berlin, 21 Nov. 1967

(NLL-M-9210-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Upper winds over GUAM and BERMUDA have characteristic diurnal variations with periods of one day predominant. Only at nine km is there a semi-diurnal oscillation over GUAM. This semi-diurnal oscillation and the differences between the contributions of winds withdiurnal periods at the two stations indicate circulation processes with large vertical motions in the euqatorial atmosphere. These processes suggest that the appreciable semi-diurnal oscillation of surface air pressure is an effect of heat influx into the atmosphere by direct absorption and by condensation. A second superimposed effect results from the stimulation of motion in a circle of inertia. At the equator this circle of inertia is vertical and takes 12 hours to go around. Author

N70-38983 National Lending Library for Science and Technology, Boston Spa (England).

SOME SPECIAL FEATURES OF THUNDERSTORMS IN MOUNTAIN REGIONS

V. A. Kamysanova 29 Apr. 1970 7 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 225, 1968 p 19 - 22

(NLL-M-9105-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The medium field intensity in mountainous regions is less than that in the plains; this effect is considered when setting the effective operating radius for thunderstorm recorders by shifting the working band to higher frequencies. Author

N70-38984 National Lending Library for Science and Technology, Boston Spa (England).

FIELD STUDIES OF THE POLLUTION OF AIR BASINS OF INDUSTRIAL TOWNS

N. S. Burenin 9 Apr. 1970 13 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 234, 1968 p 100 - 108

(NLL-M-9115-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

To find the background pollution in a town, four main residential areas and four characteristic points in each of these areas were examined. Samples of SO2, oxides of nitrogen, CO, and dust were taken at morning, afternoon, and evening observation times. Data show that the background pollution is quite high. The town atmosphere is highly polluted by CO and dust, less polluted by SO2 and oxides of nitrogen. In the fourth region concentrations above maximum permissible concentration were found in all CO samples. There are two reasons for this: (1) there was intense traffic in the given region; and (2) when the samples were taken, winds were blowing from a region where a lot of mines were. Author

N70-38999 National Lending Library for Science and Technology, Boston Spa (England).

ON THE ACCURACY OF THE RADAR METHOD OF MEASURING PRECIPITATION

A. M. Borovikov et al 24 Jun. 1970 10 p ref Transl. into ENGLISH from Tr. Cent. Aerol. Obs. (Moscow), no. 89, 1969 p 44 - 51

(NLL-M-9203-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Comparative observations are made of rain gage and radar precipitation measurements. Radar measurements were made using

film-frames of the radar screen, showing coordinate grids and regions of precipitation. Results indicate that the radar and rain gage methods show reasonable agreement in large areas, but in small areas the radar method is not yet accurate enough for reliable measurements or mapping. E.H.W.

N70-39000 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ACCURACY OF ESTIMATED AREAL AVERAGES
R. Czelnai 24 Jun. 1970 11 p refs Transl. into ENGLISH from Magy. Meteorol. Tars. Foly., Idoj. (Budapest), no. 73, 1969 p 340–350
(NLL-M-9205-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

An effort was made to extend Kagan's method for areal means to arbitary autocorrelation function and means calculated by the polygon method in a network with uneven density. A calculation procedure which could be carried out on a computer was investigated. The revised method was used to analyze areal mean monthly precipitation levels. E.H.W.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-37787# Joint Publications Research Service, Washington, D.C.
AERONAUTIC NAVIGATION EQUIPMENT
26 Aug. 1970 81 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Moscow), no. 2, 1967 p 85–87 no. 4, 1967 p 87–104 no. 5, 1967 p 85–90 no. 7, 1967 p 92–95 no. 4, 1968 p 93–103 no. 8, 1968 p 67–72 no. 1, 1969 p 84–87 no. 6 (year not given) p 91–96 (no. and year not given) p 114–118
Avail: CFSTI

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11. CERTAIN ERRORS IN INERTIAL NAVIGATION SYSTEMS E. I. Sliv et al p 67–72 (See N70-37798 21-21)

12. INERTIAL NAVIGATION SYSTEM ERRORS DUE TO INTERGRATION INACCURACY Ye. I. Sliv et al p 73–78 (See N70-37799 21-21)

N70-37798# Joint Publications Research Service, Washington, D.C.
CERTAIN ERRORS IN INERTIAL NAVIGATION SYSTEMS
E. I. Sliv et al *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 67–72 (See N70-37787 21-21)
Avail: CFSTI

An investigation is made of the effect of inaccuracies in the compensation of accelerating forces of gravity on the accuracy of determining the coordinates of a moving object in systems of inertial navigation. Author

N70-37799# Joint Publications Research Service, Washington, D.C.
INERTIAL NAVIGATION SYSTEM ERRORS DUE TO INTEGRATION INACCURACY
Ye. I. Sliv et al *In its* Aeron. Navigation Equipment 26 Aug. 1970 p 73–78 (See N70-37787 21-21)
Avail: CFSTI

The performance accuracy of an inertial navigation system as it depends on the errors of the accelerometer and integrator is investigated. Author

N70-37817 Arizona Univ., Tucson.
GENERATION OF SUPOPTIMAL, CLOSED LOOP GUIDANCE FOR MINIMUM TIME AIRCRAFT TRAJECTORIES
Teruo Ishihara (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-18335

An approximate optimal guidance scheme to achieve miniminim time flight of a simulated F-4C Phantom aircraft flying in a vertical plane between two specified points in range-altitude space was investigated. The technique involved determining the guidance program from a greatly simplified version or idealized model of the simulated aircraft. The minimum time flight equations of the idealized model were obtained from the calculus of variations. An idealized version of the aircraft was first selected and analyzed. This was based on constant values of thrust, weight, drag coefficient, and uniform atmospheric condition. By means of the calculus of variations the optimizing equations in comparatively convenient analytic form were obtained. These equations, governing minimum time flight for the idealized model, were numerically solved on a digital computer to yield an optimum trajectory between two specified points. Dissert. Abstr.

N70-37819 Utah Univ., Salt Lake City.
OPTIMAL UPGRADING OF GUIDANCE SYSTEM ERRORS BETWEEN CALIBRATIONS
Lyle Don McNeely (Ph.D. Thesis) 1969 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-18400

A method of increasing the accuracy of an inertial guidance system for the Minuteman intercontinental ballistic missile is presented. The specific problem treated is to improve the accuracy of the preflight calibration and bias update of the accelerometers during ground operation. Mathematical models for the shifts in bias and scale factor errors are developed and represented in state

space notation as a stochastic system with additive measurement noise. The recursive discrete Kalman filter is used so that separation of errors could be done on a best-estimate basis. A state vector partitioning method is introduced to reduce the computer requirements of the Kalman filter. A series of three digital filtering simulations is performed using actual accelerometer output data, and estimates are obtained for various parameters of the bias and scale factor mathematical models. Comparisons between Kalman and observer estimation are given in a series of figures, and conclusions are reached as to what state estimation process is judged best when the constraints of the problem are considered. Dissert. Abstr.

N70-37956# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
TECHNIQUES FOR GENERATING GUIDANCE SIGNALS FROM BODY-FIXED SENSORS Interim Technical Report, 10 Apr. 1969 - 10 Mar. 1970
R. D. Wetherington and J. L. Birchfield. 10 Mar. 1970. 79 p. refs.
(Contract DAAH01-69-C-1390)
(AD-707419; GIT-A-1164-1; ITR-1) Avail: CFSTI CSCL 17/7

The applicability of body-fixed sensors to the guidance of homing missiles for air intercept was investigated. Sensor types examined included optical-TV, infrared, and radar. It was concluded that within the present state-of-the-art, only the phased array radar is suitable as a body-fixed sensor for proportional navigation guidance against high-speed crossing targets. Various control system configurations for developing guidance signals from body-fixed sensors were examined. It was found that in order to implement a proportional navigation system on an air-intercept missile some form of seeker compensation is required. One method of doing this is to increase the seeker natural frequency to a very high rate; another is to feed missile attitude information to the seeker in such a manner that it effectively eliminates the effect of missile maneuvers on the seekers pointing direction. Computer simulation techniques were used to verify the theoretical results, and also to investigate the system sensitivity to rate errors and lag in the feedback network. Digital simulations of air-intercept flight were developed and are described in the Appendices. Author (TAB)

N70-37975# Army Electronics Command, Fort Monmouth, N.J.
RAPID INITIALIZATION OF INERTIAL NAVIGATION SYSTEMS THROUGH PARAMETER ESTIMATION
Joseph A. Dasaro. Mar. 1970. 104 p. refs.
(AD-706219; ECOM-3243) Avail: CFSTI CSCL 17/7

The accuracy of an aircraft inertial navigation system depends upon the accuracy with which the system is initially aligned. One procedure for initial alignment involves the use of an external reference. This method utilizes equipment which is much too elaborate for normal operational use. An alternate procedure uses the systems inertial sensors in a self-contained method. If sufficient time were available, the self-contained method could achieve accuracies commensurate with the sensor accuracies; however, in an operational environment it is usually necessary to sacrifice some accuracy in the interest of achieving a more rapid initiation. This dissertation investigates the methods presently available for initialization of an inertial platform in an azimuth wander or free azimuth instrumentation and presents a new method for rapid initialization. The paramount problem is the determination of the initial azimuth angle in minimum time in the presence of random gyro drifts, random accelerometer drifts, and measurement noise. Author (TAB)

N70-37993# IIT Research Inst., Annapolis, Md.
COMPATIBILITY FACTORS AFFECTING CONCEPT DEVELOPMENT OF APPROACH AND LANDING GUIDANCE SYSTEM
M. Maiuzzo. Electromagnetic Compatibility Analysis Center. May 1970. 110 p. refs.
(Contract F19628-69-C-0073)
(AD-707129; ESD-TR-70-134) Avail: CFSTI CSCL 17/7

Results presented in the report issue from four tasks undertaken for the FAA. These results contribute to the specification of a concept for a guidance system for approach and landing. The electromagnetic emitter environment is established for the 1975 time frame for the frequency bands, 5.0 to 5.25 GHz, 9.0 to 9.2 GHz, and 15.4 to 15.7 GHz. Possible interactions between a proposed guidance system located at John F. Kennedy International Airport and the 9.0 to 9.2 GHz band emitter/receiver environment are established. Estimates are made of the minimum number of separate channels required of a guidance system. Channel frequency separation requirements for a specific signal format/system deployment are also established. Author (TAB)

N70-38095# DBA Systems, Inc., Melbourne, Fla.
THE TESTING AND EVALUATION OF THE SHIRAN SYSTEM BY ADVANCED DATA REDUCTION METHODS, PART 2 Final Report
Maurice S. Gyer. 1 Oct. 1969. 183 p. refs.
(Contract DA-44-009-AMC-1457(X))
(AD-707418) Avail: CFSTI CSCL 8/2

The SHIRAN electronic DME subsystem of the AN/USQ-28 System was evaluated using advanced data reduction techniques which consist of determining, as part of the least squares adjustment of the range measurements, the biases inherent in the range measurements as well as the aircraft and ground station coordinates. The biases are related to transponder delay, phase measuring error, residual refraction effects, etc. The techniques exploit the observational redundancy resulting from the SHIRAN Systems high data rate and capability of interrogating up to four ground transponders simultaneously. The tests indicate that while significant biases are present in the range measurements, the biases may be precisely recovered and that the errors are considerably less than the minimum allowable specified for the system if the techniques described in the report are used to reduce the data. Author (TAB)

N70-38146# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEMS OF ORIENTATION AND GUIDANCE OF AIRCRAFT: SELECTED ARTICLES
L. A. Dmitrochenko et al. 5 Sep. 1969. 30 p. refs. Transl. into ENGLISH from Tr. Aviats. Inst. (USSR), no. 179, 1968 p 20-29; 110-142
(AD-696052; FTD-MT-24-148-69) Avail: CFSTI CSCL 17/7

Contents: Correcting inertial systems by using astronomical instruments; Hydrodynamic suspension-forces and centering; Calculation of the force characteristics of the external spherical suspension device of a cryogenic cyroscope. TAB

N70-38167*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE USE OF STATISTICS IN GUIDANCE ANALYSIS
Donald H. Galli. 12 Sep. 1969. 35 p. refs.
(NASA-TM-X-53903; MSFC-IN-68-2) Avail: CFSTI CSCL 17G

A statistical analysis of space guidance systems, based on the properties of multivariate Gaussian distributions and linear perturbation theory, is discussed. The results of this analysis can be applied to any mission regardless of the nature or complexity of the trajectory or the guidance system, as long as the linear perturbation theory is valid. The theory needed to statistically describe the injection errors, trajectory dispersions at the target due to the injection errors, and the calculation of the average midcourse maneuver of a guided spacecraft are reviewed. Author

N70-38178# Department of Transportation, Washington, D.C.
DEPARTMENT OF TRANSPORTATION NATIONAL PLAN FOR NAVIGATION
May 1970 35 p
(AD-706965) Avail: CFSTI CSCL 17/7

A plan for the operation, development and implementation of existing and possible future navigation systems for civil aviation and maritime requirements is presented. Areas of air and marine commonality are discussed with the objective of minimizing the number of radionavigation aids. Specific Federal Aviation Administration and Coast Guard programs for research and development of navigation systems, and an operating plan into the 1980's are described. Special emphasis is placed on long distance air navigation and high seas marine navigation. Typical of navigation systems considered are Inertial, Loran, Omega and Satellite. New Statements of Policy in regard to long distance navigation aids are proposed to replace the current U. S. policy adopted by the Air Coordinating Committee on 23 December 1958. Author (TAB)

N70-38599# Palmer (Winslow), Babylon, N.Y.
DUPLEX OPERATION OF THE OMEGA TRANSMITTING ANTENNA
Winslow Palmer Nov. 1968 74 p refs
(Contracts N00024-67-C-1416; N00024-67-R-3446)
(AD-707068; OMEGA-TN-14) Avail: CFSTI CSCL 17/7

The very large effective height of the OMEGA Transmitting antenna makes it a very effective receiving antenna for system monitoring, with the advantage that using the transmitting antenna for receiving removes all errors due to re-radiation and distance between transmitter and monitor. However, to receive distant signals while transmitting requires over 200 DB discrimination against the local signal. This high level of discrimination can be provided by the combination of a balanced hybrid transformer, notch filters, adjacent channel rejection and high level signal processing. Phase shift errors in the remote signals due to antenna detuning and receiver phase shift is avoided by tracking the signals by injecting a local tracking signal into the antenna circuit to cancel distant signals. Simultaneous tracking of the signals of all eight stations on four or more frequencies can be accomplished. Author (TAB)

N70-38709# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1970
Herbert G. Weiss 15 May 1970 11 p refs
(Contract AF 19(628)-5167)
(AD-707137; ESD-TR-70-95) Avail: CFSTI CSCL 17/7

Because the allowable effort on ATC is comparatively small, it has been focused on only one facet of the problem; namely, on the data acquisition and communications task. The new group has started to make significant progress in several study aspects of the problem and has also obtained experimental L-band multipath data from an experimental air-ground test system. When additional support is received, the program will be expanded to include over-all system design studies and the investigation of radar improvements and multilateration systems, both ground- and satellite-based. Author (TAB)

N70-38871# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOTECHNICAL FACILITIES FOR NAVIGATION
V. Ivashkevich et al 15 May 1970 14 p Transl. into ENGLISH from Radio (Moscow), no. 7, 1969 p 11 - 13
(AD-707181; FTD-HT-23-251-70) Avail: CFSTI CSCL 17/7

The article discusses the purpose of and working principles of several systems and instruments of radionavigation facilities. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-37725# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
THE REACTIVES OF HIGH FLUX ISOTOPE REACTOR FUEL ELEMENTS 73 THROUGH 86
E. B. Johnson and R. K. Reedy 15 May 1970 5 p refs
(Contract W-7405-eng-26)
(Y-DR-27; Memo-9) Avail: CFSTI

The reactivity of each of 14 additional fuel elements recently manufactured for the High Flux Isotope Reactor (HFIR) was determined. The measured reactivities of these elements, moderated and reflected by water, ranged between $-202.8 + or - 14.9$ cents and $-299.8 + or - 16.5$ cents. The reactivities based on recalibration of the neutron-absorbing strips are given. Because some of these elements exhibited much lower reactivities than had any of the vendor-manufactured ones tested previously, attempts were made to determine whether the low reactivity was due to the inner or to the outer annulus. Author

N70-37737 National Lending Library for Science and Technology, Boston Spa (England).
PEACEFUL PROFESSION OF NUCLEAR BLAST Interview with Chairman of the USSR State Committee for Atomic Energy Utilization A. M. Petrosyants
24 Jun. 1970 3 p Transl. into ENGLISH of Komsomolskaya Pravda, 1 Nov. 1969 Interview held 12 Nov. 1969
(NLL-M-9234-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Policies governing nuclear research are discussed. Topics mentioned are: peaceful applications of nuclear energy, underground testing, and radiation safety. E.C.

N70-37911# Engineering-Physics Co., Rockville, Md.
HYDRO SHOCK EXPERIMENT Final Report, Feb. - Oct. 1969
Edwin Miller and Vincent J. Cushing Jan. 1970 17 p
(Contract N00014-69-C-0238)
(AD-706767) Avail: CFSTI CSCL 18/3

A number of small scaled explosions were carried out. The source of the explosion is an exploding wire, energized by rapid discharge from an electrical capacitor. The explosions are nuclear-like in that there are substantially no combustion products. In order to approximate a point-source explosion, the exploding wire consisted of No. 40 nichrome wire with lengths ranging from 2.3 mm to 4.5 mm. Burst points ranged from a depth of 63.5 mm beneath the water surface to an altitude of 100 mm. Bubble growth and progress of shock fronts in the air and in the water were followed through a schlieren optical system by means of very high speed photography. Pressure-time information, in the water only, was provided by piezoelectric gages. Surface waves were followed by means of high speed photography. Author (TAB)

N70-37949# Staatliche Zentrale fuer Strahlenschutz, Berlin (West Germany).
EVALUATION OF THE VOLATILE RADIOACTIVE RELEASES FROM NUCLEAR INSTALLATIONS FOR VARIOUS OPERATING CONDITIONS
W. Schimmel Dec. 1969 17 p refs In GERMAN
(SZS-15/69) Avail: AEC Depository Libraries

The volatile radioactive releases from nuclear installations are analyzed. Fundamental accident analysis is outlined for an incident caused by a large loss of coolant. The consequences for the installation as well as the environment are shown. Author (NSA)

N70-37950# Kernforschungszentrum, Karlsruhe (West Germany).
SUPERCONDUCTING SYNCHROTRON ON THE BASIS OF A MAGNET SYSTEM WITH STATIONARY FIELD
N. I. Doynikov et al. [1969] 11 p Transl. into GERMAN from the Russian In GERMAN
(KFK-TR-307; CONF-690811-13) Avail: AEC Depository Libraries

Because of the small weight of superconducting electromagnets, the possibility of the field alteration was tested on the synchrotron path by mechanical displacement of the superconducting electromagnets with stationary magnetic fields. Estimations show that, for the mechanical displacements, powers are necessary which are smaller by a fraction than for the production of corresponding time-varying fields. Two possible variations of such a synchrotron are investigated: a synchrotron device in which the alteration of the rotating field is produced by synchronous rotation of the electromagnet with a stationary field; and the synchrotron variant with radial countercurrent displacement of adjacent electromagnets. An example of the construction variants of the rotating magnets of an accelerator is given. NSA

N70-37989# Army Engineer Reactors Group, Fort Belvoir, Va. Engineering Div.
MH-1A CORE PHYSICS TEST REPORT Final Report
C. Frederick Sears and Michael V. Gregory 16 Mar. 1970 46 p refs
(AD-707453; ED-7002) Avail: CFSTI CSCL 18/9

Core physics measurements were performed in November 1969 on the first refueled core of the MH-1A (Sturgis). The report presents and analyzes the data recorded. The basic physical parameters describing the core are derived and compared with the pre-refueling values and the theoretical values. Author (TAB)

N70-38023# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PROPERTIES OF LEVELS INDUCED BY 0 TO 30 keV NEUTRONS IN STABLE ISOTOPES OF TELLURIUM [PROPRIETES DES NIVEAUX INDUITS PAR DES NEUTRONS D'ENERGIE COMPRISE ENTRE 0 ET 30 KEV DANS LES ISOTOPES STABLES DU TELLURE]
Henry Tellier, Michel Alix, and John Dabbs Feb. 1970 79 p refs In FRENCH
(CEA-N-1268) Avail: AEC Depository Libraries

Total cross section measurements were carried out by the time-of-flight method for the tellurium isotopes. The Saclay linac was used as a neutron pulsed source. Resonance parameters were obtained by a shape analysis. For each isotope the strength function and level density parameter were obtained. Author (NSA)

N70-38024# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
FISSION PRODUCT INVENTORIES. PART 1: THE CALCULATION METHOD AND PROGRAM FISP
R. H. Clarke and R. E. Utting Aug. 1969 31 p refs
(RD/B/N-1427-Pt-1) Avail: AEC Depository Libraries

The equations governing the production and decay of fission products have been programmed for the IBM 360/75 computer. The program, which has been called FISP, considers all fission products with half-lives greater than about 1 second between Zn-72 and Tb-61 and the yields of these fission products are tabulated for thermal fission in U-235, Pu-239 and Pu-241 and for fast fission in U-235, Pu-239, Pu-241 and U-238. Details for running the program are presented together with instructions for modifications to the yield values either for revised data or for alternative fission sources. Author (NSA)

N70-38044# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
BURN-OUT POWER AND PRESSURE DROP MEASUREMENTS ON 12-FT 7-ROD CLUSTERS COOLED BY FREON-12 AT 155 PSIA
R. A. Heron, J. H. Kinneir, G. F. Stevens, and R. W. Wood Sep. 1969 36 p refs
(AEEW-R-655) Avail: AEC Depository Libraries; HMSO: 5s 6d; BIS $1.10

Burnout power and pressure drop measurements are reported for six 7-rod clusters of 12 ft heated length, cooled by Freon-12 at 155 psia in vertical upflow. The clusters had the same rod diameter and shroud tube bore, but the pitch circle of the ring of rods was varied from the smallest possible diameter to the largest possible diameter. All the clusters thus had the same value of equivalent diameter based upon a ratio of flow area to heated perimeter, and the results of the experiments provide a critical test of the validity of this concept. Both pressure drop and burnout power were found to vary significantly with change of pitch circle diameter showing that the concept is an inadequate representation of a rod cluster in boiling heat transfer. Author (NSA)

N70-38080# Oak Ridge National Lab., Tenn.
WEAPONS RADIATION SHIELDING HANDBOOK. CHAPTER 2: BASIC CONCEPTS OF RADIATION SHIELDING ANALYSIS
Paul N. Stevens and H. Clyde Caliborne Jun. 1970 83 p refs Sponsored by DASA
(AD-707082; DASA-1892-5) Avail: CFSTI CSCL 18/6

The basic concepts underlying the methods used for weapons radiation shield analysis are described in this chapter. They include the quantities used to describe particle populations and the quantities used to describe radiation interactions with materials. The characteristics of the particular radiations produced by weapons, neutrons and gamma rays, are discussed in detail, including their physical properties and their important interactions. The production processes whereby neutrons and gamma rays are produced are also described. In addition, the chapter discusses the various response functions that are used to convert a radiation field to a biological effect. Author (TAB)

N70-38107# National Bureau of Standards, Washington, D.C.
RADIOACTIVITY CALIBRATION STANDARDS Conference Proceedings
W. B. Mann and S. B. Garfinkel, eds. GPO Aug. 1970 123 p refs Proc. of a Spec. Sess. of the Intern. Conf. of the Am. Nucl. Soc. Meeting on the Constructive Uses of At. Energy, Washington, D.C., 10 - 15 Nov. 1968
(NBS-Spec-Publ-331) Avail: SOD $1.25 Catalog No. C-13.10:331

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3. INTERNATIONAL COMPARISONS OF CALIBRATED RADIONUCLIDE SOURCES A. Rytz (Bureau Intern. des Poids et Mesures) p 25 - 36 (See N70-38110 21-22)

4. STANDARDIZATION OF RADIONUCLIDES BY EFFICIENCY-TRACING METHODS USING A LIQUID-SCINTILLATION COUNTER D. G. Jones and A. McNair (Radiochem. Centre) p 37-52 refs (See N70-38111 21-14)

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7. METEOROLOGY OF RADIOACTIVE ISOTOPES AT THE BORIS KIDRIC INSTITUTE OF NUCLEAR SCIENCES Dj. N. Bek-Uzarov (Inst. za Nuklearne Nauk, Boris Kidric) p 79-103 refs (See N70-38114 21-22)

8. RECENT ACTIVITIES OF THE NBS RADIOACTIVITY SECTION WITH SPECIAL REFERENCE TO THE STANDARDIZATION OF THALLIUM-208 S. B. Garfinkel and J. M. R. Hutchinson p 105-118 refs (See N70-38115 21-22)

N70-38108# International Atomic Energy Agency, Vienna (Austria).

ASPECTS OF RADIONUCLIDE STANDARDIZATION IN THE IAEA

H. Houtermans *In* NBS Radioactivity Calibration Std. Aug. 1970 p 5-12 (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

The procedures for distribution of radionuclide standards by the IAEA Laboratory are discussed. The current trend toward registering and comparing calibration results obtained from other laboratories is considered. The proposed plan permits different laboratories to compare their results with those of other institutions, regardless of the time the calibrations are performed. R.B.

N70-38109# European Atomic Energy Community, Geel (Belgium). Central Bureau of Nuclear Measurements.

SOME ASPECTS OF RADIOACTIVITY STANDARDIZATION AT THE CBNM OF EURATOM

A. Spernol *In* NBS Radioactivity Calibration Std. Aug. 1970 p 13-24 (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

The work of the radionuclides laboratory of the CBNM on direct neutron research, standardization, and research on improving the accuracy of radioactivity measurements is discussed. Emphasis is given to the accuracy of radioactivity measurements, including development and improvement of methods, accurate determination of nuclear and atomic constants involved in radioactive decay, and investigation of the physical effects which limit the accuracy of the measurements. R.B.

N70-38110# Bureau International des Poids et Mesures, Sevres (France).

INTERNATIONAL COMPARISONS OF CALIBRATED RADIONUCLIDE SOURCES

A. Rytz *In* NBS Radioactivity Calibration Std. Aug. 1970 p 25-36 (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

International cooperation in establishing laboratories for comparison of radionuclides is discussed. The original program suggested a desirable accuracy of + or - 1%, and 0.1% in special cases. The work directed toward eliminating and accounting for errors in measurement is summarized. R.B.

N70-38112# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etude Nucleaires.

VALIDITY OF RADIOACTIVE STANDARDS

Y. Le Gallic *In* NBS Radioactivity Calibration Std. Aug. 1970 p 53-68 (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

Standards of radionuclide measurements are considered as a function of the development of primary standards in each metrological laboratory, joint international cooperation in the study of fundamental constants such as decay schemes and half life, and international agreement to standardize the statement of results and errors. It is observed that nuclear metrology laboratories must also develop primary standards of exposure rate and energy fluence. Author

N70-38113# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

RADIOACTIVITY STANDARDIZATION IN CANADA

J. G. V. Taylor and A. P. Berg NRC of Can., Ottawa) *In* NBS Radioactivity Calibration Std. Aug. 1970 p 69-77 refs Prepared jointly by At. Energy of Can., Ltd. and NRC of Can., Ottawa (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

The work of the two government organizations engaged in radioactivity standardization in Canada is discussed. The primary absolute method used by both laboratories is 4 pi beta-gamma coincidence counting. Basic research on improving absolute methods is conducted and measurements and intercomparisons are carried out with other national and international laboratories. R.B.

N70-38114# Institut za Nuklearne Nauk (Boris Kidric), Belgrade (Yugoslavia).

METEOROLOGY OF RADIOACTIVE ISOTOPES AT THE BORIS KIDRIC INSTITUTE OF NUCLEAR SCIENCES

Dj. N. Bek-Uzarov *In* NBS Radioactivity Calibration Std. Aug. 1970 p 79-103 refs (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

A survey of the activities of the department of Radioactive Isotope Meteorology of the oris Kidric Institute of Nuclear Sciences at Vinca is given. Some problems with which the department is involved in developing counters used for absolute measurement of the number of decays are presented. Work on the estimation of air-equivalent materials for the production of air-equivalent cavity ionization chambers is also surveyed. Author

N70-38115# National Bureau of Standards, Washington, D.C.

RECENT ACTIVITIES OF THE NBS RADIOACTIVITY SECTION WITH SPECIAL REFERENCE TO THE STANDARDIZATION OF THALLIUM-208

S. B. Garfinkel and J. M. R. Hutchinson *In its* Radioactivity Calibration Std. Aug. 1970 p 105-118 refs (See N70-38107 21-22)

Avail: SOD $1.25 Catalog No. C-13.10:331

The work of the Radioactivity Section of NBS in developing, preparing, and maintaining radioactivity standards for the United States is discussed. A majority of the standards is distributed and a calibration service covering most of the radionuclides studied by the laboratory is provided. The various techniques and equipment in establishing standards of radioactivity are described. R.B.

N70-38133# United Kingdom Atomic Energy Authority, Harwell (England).

EXPERIENCE TO DATE WITH MARK 4 FUEL ELEMENTS FITTED WITH DBF-4 GUIDE NOSES

Feb. 1969 8 p refs Transl. into ENGLISH from the Russian (NP-TR-1883) Avail: AEC Depository Libraries

The performance in FRJ-2 Reactor of Mark 4 fuel elements with DBF-4 spacing guides is described. Required fuel element modifications for the DBF-4 spacing guides are presented. NSA

N70-38222# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
FUEL ROD BUNDLES WITH VARIOUS SPACER DESIGNS FOR SODIUM COOLED FAST REACTORS
W. Baumann, H. Hoffmann, and R. Moeller Mar. 1970 25 p refs
(KFK-1154; SM-130/38) Avail: AEC Depository Libraries

The pressure drop in a Na-cooled multirod fuel element and the temperature profile across its outlet section are calculated as a function of different rod arrays for grid- and helical-type spacers. These considerations are based on experimental pressure drop and coolant cross-mixing investigations. Author (NSA)

N70-38234# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
USE OF NEUTRON-ABSORBING ADDITIONS TO THE COOLANT FOR SHUTDOWN OF FAST SODIUM-COOLED REACTORS
K. E. Schroeter, K. Mauback, and S. Dorner Feb. 1970 28 p refs
(KFK-1153; SM-130/37) Avail: AEC Depository Libraries

An independent shutdown system for Na cooled reactors is discussed. The principle of operation consists in poisoning the coolant with metals soluble in Na, i.e., miscible metals. Of all the materials considered Li with higher Li-6 concentrations is most suitable. The miscibility of Li with Na is safeguarded for the conditions of concentration if the temperature does not fall below 150° C. After the coolant has been poisoned, Li can be separated from Na by simple methods. The corrosion problems which may arise play no major part. Calculations show that already small concentrations on Li-6 in the coolant of a breeder reactor give rise to considerable shutdown reactivities. For the Na-cooled 300 MW(e) reactor Na2, a technical concept is indicated by means of which the primary cycle can be poisoned in emergencies. The main principle consists in an automatic self-dosage of the poisoning by a Venturi nozzle. Quick-acting Li injectors bridge the startup phase of the automatic poisoning system. Author (NSA)

N70-38235# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
METHOD FOR THE EXPERIMENTAL INVESTIGATION OF THE VIBRATION STATES OF FUEL RODS INDUCED BY COOLANT FLOW [METHODE FUER DIE EXPERIMENTELLE UNTERSUCHUNG DES DURCH DIE KUEHLMITTELSTROEMUNG HERVORGERUFENEN SCHWINGUNGSZUSTANDES DER BRENNSTAEBE]
J. Kadlec and K. D. Appelt Nov. 1969 57 p refs In GERMAN; ENGLISH summary
(KFK-1082) Avail: AEC Depository Libraries

Experimental investigation of hydrodynamically induced lateral vibrations of pins of fuel subassembly with many spacer grids is presented. The proposed investigation method is based on the determination of the spectral density function of the bending strain at one location of the pin, which is used as a basis for calculation of spectral density functions of the displacement or of the bending stress at other locations of the pin. The proposed procedure was used for the investigation of parallel flow-induced-vibration of pin of the subassembly model of the Na 1 fast breeder reactor study. The experimental setup and the digital data acquisition system are described. The RMS-values as well as the spectral density functions of the lateral vibration of the fuel pin and of the whole subassembly, as well as of the boundary layer pressure fluctuations at the subassembly wall, are presented. NSA

N70-38242# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Feb. - 30 Apr. 1970
L. E. Steele, C. Z. Serpan, Jr., J. R. Hawthorne, J. M. Krafft, and R. A. Gray, Jr. 15 May 1970 55 p refs
(AD-707336; NRL-MR-2126) Avail: CFSTI CSCL 18/10

The report includes: (1) results of a damage function approach to spectrum analysis for Army reactor SM-1, (2) analysis for fracture resistance in heavy thickness A533-B steel plate and weld metal, (3) the role of iron in the fracture of an irradiated pressure vessel steel, (4) the nature of observed radiation damage in vanadium, and (5) the effects of the fast reactor environment on the tensile properties of selected structural and cladding alloys. Author (TAB)

N70-38283 International Atomic Energy Agency, Vienna (Austria).
TOPICS IN LIGHT WATER REACTOR PHYSICS: THE NORA PROJECT Final Report, 1964 - 1968
E. Andersen, D. Babala, J. O. Berg, K. Bryhn-Ingebrigtsen, J. M. Doederlein et al 1970 121 p refs
(IAEA-R-104-F; TR-113) Copyright: Avail: Issuing Activity

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N70-38284 International Atomic Energy Agency, Vienna (Austria).
THE NORA PROJECT: A REVIEW
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 1 - 6 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

Major results in zero power reactor statistics and kinetics of the NORA project are: (1) development of a general theory of neutron counting statistics; (2) establishment of the pulsed neutron source method for getting approximative values of large negative reactivities; (3) control absorber reactivity measurement interpretation; (4) thermal spectrum variation measurements near fuel rods and control absorbers; (5) development of nuclear track detector techniques; (6) perturbation effects on thermal neutron density disadvantage factors; (7) flux density transients affects on radial buckling measurements; and (8) measurements of temperature coefficients from room temperature to about 60 deg. G.G.

N70-38285 International Atomic Energy Agency, Vienna (Austria).
ZERO POWER REACTOR NOISE
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 6 - 21 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

The general theory of neutron counting statistics appears to be very convenient for applications in noise measurements. It readily yields expressions for the statistical quantities of interest, and in the point reactor model, it makes the theoretical explanation of the Type II Rossi-alpha-experiment and the derivation of interval probability distribution comparatively simple. The difference between the two types Rossi-alpha-methods lies only in the

amplitude of the exponential term in the conditional probability. The amplitude is smaller in the Type II experiment, but it increases with decreasing counter efficiency of the triggering detector and approaches the amplitude of the Type I experiment. The spatial effects can be studied by the Rossi-alpha method, as is indicated by the presence of the second exponential term in the Rossi-alpha formula. The values for alpha sub c = beta/lambda derived from the different experiments are given in the table and serve as a check on the accuracy of the methods. Author

N70-38286 International Atomic Energy Agency, Vienna (Austria).
PULSED NEUTRON SOURCE TECHNIQUE
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 21-33 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

The pulsed source method has proved to be a powerful method of studying subcritical reactors. In a region from criticality to a few dollars subcritical, this technique gives an accurate and fast determination of reactivity. At lower reactivities, difficulties exist, because of the inconsistency between the theoretically determined static reactivity and the result of a kinetic experiment. This effect exists for all types of kinetic measurements, and limits the usefulness of the reactivity concept. A more basic parameter than the reactivity has been used for a comparison between theory and experiment. This is the prompt flux fundamental mode decay constant, which is easily measured and can be calculated using a static diffusion code. Quite good agreement is obtained between measured and predicted values. Author

N70-38287 International Atomic Energy Agency, Vienna (Austria).
CONTROL ABSORBER REACTIVITIES
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 33-47 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

Two different series of experiments on control absorber efficiencies were performed within the NORA light water reactor physics program. The first series used cadmium plates in various geometries to compare different methods for measuring control absorber efficiencies. The rod drop experiment was established as the most reliable method in cases with a single rod, while core-building technique offered a practical and unambiguous technique for cases with both single and several control absorbers. The second series of absorber experiments used boron-steel plates containing about 1% natural boron in various geometries covering a wide range of optical thicknesses; the reactor designs. It was of primary interest in these experiments to obtain results from a wide range of conditions with respect to absorber geometries, control rod optical thicknesses for thermal neutrons, ratios between thermal and epithermal control absorptions. Comparison with theoretical results confirmed that available theoretical methods were able to calculate the absorber efficiencies with high degree of accuracy for all conditions investigated. Author

N70-38288 International Atomic Energy Agency, Vienna (Austria).
THERMAL LATTICE SPECTRA WEAR ABSORBERS
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 47-61 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

The spatial variation of the spectrum index has been measured for a number of cores containing grey absorber elements. Measurements have also been performed for corresponding unperturbed or clean cores. The experimental results have been interpreted theoretically, using the computer code MONTROSA. MONTROSA is a Monte Carlo code which calculates thermal neutron spectra in clean cells and cells bounded by plane absorbers. The experimental and the calculated results clearly show that there is a hardening of the spectrum as well in fuel as in moderator near to the different absorbers. However, the hardening effect is found to propagate a rather small distance into the regular lattice, usually not more than 1-2 unit cells. Author

N70-38290 International Atomic Energy Agency, Vienna (Austria).
CELL PARAMETERS, BUCKLINGS AND REACTIVITY COEFFICIENTS
In its Topics in Light Water Reactor Phys.: The NORA Proj. 1970 p 72-102 (See N70-38283 21-22)
Copyright. Avail: Issuing Activity

During the present programme only three different moderator-to-fuel volume ratios have been studied. The measurement of the thermal neutron density disadvantage factors for the various H2O lattices in NORA was a direct continuation of the work started in the beginning of the NORA Project. The various perturbations caused by the presence of foils and wires in the unit cell have been studied in quite some detail. The development of the solid state nuclear track detector techniques made it possible to measure also the fast advantage factor, and offered possibilities to measure other conventional cell parameters. Material bucklings have been measured for the three different moderator-to-fuel volume ratios using standard flux mapping technique. Foils sensitive to other neutron energies than thermal were also used in these experiments. Measurements of the water level coefficients and also the temperature coefficient of a few H2O moderated cores have been performed. The measured temperature coefficient has been compared with theoretical results coming from various lattice codes and agreement was found to be good when the more sophisticated lattice codes were used. Author

N70-38307# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
BEHAVIOR OF UO2 AEROSOLS IN CLOSED SYSTEMS [DAS VERHALTEN VON UO2 AEROSOLEN IN GESCHLOSSENEN SYSTEMEN]
W. Schikarski and H. Wild Dec. 1969 67 p refs In GERMAN; ENGLISH summary
(KFK-1032) Avail: AEC Depository Libraries

The behavior of aerosols which can be formed during large accidents of fast nuclear reactors is investigated. The program is aimed at the development and at experimental verification of the aerosol model which describes activity release via the transport characteristics of nuclear aerosols. The behavior of UO2 aerosols in an inert atmosphere is analyzed. The UO2 aerosols were created by the exploding wire technique in two different stainless steel vessels of 2.2 cu m and 0.02 volume. The decrease of the particle number concentration and of the mass concentration with time was measured for various time intervals up to one week. The shape of the time functions of particle number concentrations allows separation into three ranges. The primary range can be attributed to the coagulation process, the final range can be attributed to the sedimentation process. An analytical expression was developed which gives, by means of an empirical term, good agreement between experiment and theory. Author (NSA)

N70-38329# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
CRITERIA FOR ACTION LEVELS FOR INSPECTION BASED ON A GAME THEORETICAL MODEL
E. Hoepfinger Dec. 1969 19 p Presented at the IAEA Conf. on Systems Analysis, Vienna, 25-29 Aug. 1969
(KFK-909; CONF-690826-2) Avail: AEC Depository Libraries

A theoretical model for analyzing a safeguards system for nuclear materials management is presented. The model is based

on flow measurements of fissile material. The optimum behavior of the facility's profit-maximizing operator and safeguards authority is defined and determined. NSA

N70-38438# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
FAST NEUTRON TRANSMISSION MEASUREMENTS FOR REACTOR CORE AND SHIELDING MATERIALS Technical Progress Report
W. Meyer, J. O. Mingle, and D. H. Timmons (Missouri Univ., Columbia) Feb. 1970 51 p refs
(Contract AT(11-1)-2049)
(COO-2049-1) Avail: CFSTI

Work is described on: the definition of the "standard neutron penetration experiment," optimization of neutron spectrometer operating characteristics, intercalibration of the NE-213 fast-neutron spectrometer with the spectrometers of other laboratories, re-evaluation of existing methods and structuring of approximate and direct design methods applicable to neutron transport problems, and measurement of neutron penetration spectra. Existing transport codes ANISN and SLABO were adapted to the 360/50 computer and theta and phi angular-dependent invariant-imbedding neutron transport code was developed. The applicability of one-dimensional and two-dimensional discrete ordinate codes and Monte Carlo codes to various experimental neutron penetration geometries was studied. NASA

N70-38439# Battelle-Northwest, Richland, Wash. Fluid and Energy Systems Dept.
PROPERTIES OF AIR-STEAM MIXTURES CONTAINING SMALL AMOUNTS OF IODINE
J. G. Knudsen (Oregon State Univ.) Apr. 1970 89 p refs
(Contract AT(45-1)-1830)
(BNWL-1326) Avail: CFSTI

A tabulation of the physical properties of a saturated steam-air atmosphere is presented for a range of temperature (from 60 to 300 F) and pressure (from 14 to 70 psia). The physical properties tabulated include molecular weight, mole fraction, density, viscosity, thermal conductivity, heat-capacity, Prandtl number, diffusivity, and Schmidt number for steam, elemental iodine, and methyl iodide. The equations on which the tabulated data are based are referenced. In addition, constants needed for calculating terminal settling velocities of spherical drops are provided. The tabulated data are required in calculations for predicting heat and mass transfer in containment vessels of nuclear water reactors. Author (NSA)

N70-38440# Los Alamos Scientific Lab., N. Mex.
OBSERVATIONS OF UHTREX FUEL ELEMENTS DURING REACTOR STARTUP OPERATIONS
Larry Weintraub May 1969 14 p
(Contract W-7405-eng-36)
(LA-4411) Avail: CFSTI

Studies of the fuel element performance during initial UHTREX reactor operations were undertaken to assess the degree of attrition and other effects on fuel element materials. Observations included pre- and postexposure weighing, precise measurements of the fuel element dimensions, and photography. In addition, radiographic and metallographic examinations of sections of one element were conducted. The onset of corrosion effects was found to occur after exposure to reactor environments associated with operations above coolant outlet temperatures of 1900 F. Only minimal indications of fuel migration through the coated fuel particles were observed. The metallographic examination showed no evidence of particle or matrix damage. Author (NSA)

N70-38466# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
FORMULATION AND APPLICATION OF ANALYTIC REPRESENTATIONS OF FAST REACTOR FLUX AND IMPORTANCE SPECTRA
Floyd E. Dunn and Martin Becker [1969] 29 p refs
(Contract AT(30-1)-328)
(RPI-328-189) Avail: CFSTI

A model is developed for the study of fast reactor flux and importance spectra. The model is based on slowing down theories of the continuous slowing down type with suitable modifications introduced where such theories are deficient. The ability to obtain an analytic solution for the flux and importance spectra depends on the ability to fit basic cross section ratios (such as the moderating ratio) to simple analytic forms. The cross section fits are used to obtain an expression for the slowing down density, which generally is a smooth function. Detailed cross sections, however, are used to relate flux and importance to slowing down density. The model yields good agreement with multigroup spectra on both broad group and ultra-fine group bases and yields quite accurate values for integral parameters (e.g., criticality and reaction rates). In addition, it is found to be possible to get a good correlation of cross section fit parameters with composition. Author (NSA)

N70-38471# Atomic Power Development Associates, Inc., Detroit, Mich.
AEC SPONSORED ACTIVITIES Quarterly Technical Progress Report, Oct. - Dec. 1969
Dec. 1969 48 p refs
(Contract AT(11-1)-865)
(APDA-251) Avail: CFSTI

Tube wastage by sodium-water reactions in steam generators is analyzed. Test results for Cr-Mo-steel tubes and carburized Type 316 stainless steel capillaries are presented. A comparison of methods for calculating and measuring heterogeneity effects in fast reactor critical assemblies and power reactors is presented. NSA

N70-38481# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CHEMICAL-MECHANICAL CLEANING OF SMALL-DIAMETER TUBING
R. R. Studer May 1970 13 p
(Contract AT(45-1)-1830)
(BNWL-1376) Avail: CFSTI

One requirement of FTR fuel cladding tubes is freedom from contaminating substances, particularly on internal surfaces. Other technical requirements of the tubes can only be met by tube manufacturing methods which, inherently, make cleaning difficult. Visual or mechanical examination of small-diameter tubes to determine presence or absence of gross soils is uncertain and may be damaging. The best assurance of uniform cleanliness is a completely effective cleaning operation. Such an operation has been developed, and a brushing/rinsing machine has been designed to make it practical. The machine was designed to give maximum protection to the tube being cleaned. Author (NSA)

N70-38522# European Nuclear Energy Agency, Paris (France).
EUROPEAN NUCLEAR ENERGY AGENCY ELEVENTH ACTIVITY REPORT, DECEMBER 1969
Dec. 1969 93 p
(NP-18211) Avail: AEC Depository Libraries

Topics discussed include: Joint Undertakings and Common Services; Nuclear Power; Scientific and Technical Cooperation; Health and Safety; and Legal Affairs. NSA

N70-38523# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ACTIVATION AND SHIELDING OF FTR SODIUM
C. A. Mansius Apr. 1970 32 p refs
(Contract AT(45-1)-1830)
(BNWL-1339) Avail: CFSTI

The Fast Test Reactor (FTR) primary coolant is calculated to contain 1.2 × 10 to the 7th power Ci of Na-24 and about 100Ci of Na-22 under equilibrium conditions at 400 MW. Each closed loop will contain about 30,000 Ci of Na-24 and almost one Ci of Na-22. These values are based on two-dimensional, 31-neutron group diffusion theory calculations employing conceptual design dimensions and compositions for the arrangement within the reactor vessel. Shielding calculations are presented for piping, pumps, and heat exchangers containing activated sodium that provide a basis for shield design of pipeways and heat transport cells.
Author (NSA)

N70-38524# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
POWER TESTS WITH THE UO2 2WT. % PuO2 BATCH CORE IN THE PRTR
J. W. Kutcher and R. I. Smith May 1970 53 p refs
(Contract AT(45-1)-1830)
(BNWL-1383) Avail: CFSTI

As a part of the BATCH CORE EXPERIMENT in the Plutonium Recycle Test Reactor (PRTR), a series of power tests was conducted when the reactor loading was completed, at various powers up to 60 MW. These tests were designed primarily to verify predicted operational characteristics of the PRTR with the BATCH CORE loading, but also included those physics tests which required power operation. The tests included flux traverses, operation of the traveling flux wire system, transient response of the reactor to D2O moderator, determination of reactor power, temperature coefficients of reactivity, kinetics parameters, and the growth and decay of fission product poisoning. Results of these tests are presented.
Author (NSA)

N70-38532# Oak Ridge National Lab., Tenn. Reactor Div.
FORMATION AND REMOVAL OF RADIOACTIVE ORGANIC IODIDE
Susumu Kitani May 1970 15 p refs Transl. into ENGLISH from Genshiryoku Kogyo (Japan), v. 14, no. 5, 1968 p 48–51
(ORNL-tr-2333) Avail: CFSTI

Data are tabulated on gases released from unirradiated UO2 heated to high temperature. Possible mechanisms of methyl iodide formation from methane and iodine released from irradiated UO2 are examined. The effectiveness of activated charcoal filters and chemical additives for removal of methyl iodide is described, and the effects of temperature, humidity, flow rate, etc., on methyl iodide removal are discussed.
NSA

N70-38539# North Carolina State Univ., Raleigh.
COMPUTER EXPERIMENT STUDIES ON MECHANISMS FOR IRRADIATION INDUCED DEFECT PRODUCTION AND ANNEALING PROCESSES Progress Report, Period Ending 30 Nov. 1969
J. R. Beeler, Jr. Dec. 1969 58 p refs
(Contract AT(40-1)-3912)
(ORO-3912-2) Avail: CFSTI

Results of work in impurity effects and on void formation and growth in reactor materials are reported. Parallel to these studies, a systematic review of variational and dynamical method computational techniques were initiated. Examination of impurity effects concerned the behavior of carbon atoms near vacancy point defects and near free surfaces (voids). Johnson's atomic interaction functions were used as the basis for this examination. Flow diagrams of defect and impurity atom behavior mode combinations are included. A program to simulate compact, faceted void formation and growth from the stringy aggregates produced in a primary damage state was started. The program is used to analyze the anisotropy of vacancy (defect) diffusion near a void (free surface) and long-range migration effects, as well. It is the prototype program for our high-temperature modification of the ANNEAL Program. Problems in computational technique were uncovered in simulation runs which converge to a metastable state rather than to the equilibrium state.
NSA

N70-38545# Iowa State Univ. of Science and Technology, Ames.
REACTOR MATERIALS DEVELOPMENT Quarterly Report, Jan. – Mar. 1970
A. F. Voight, ed. Mar. 1970 15 p refs
(IS-RD-21) Avail: CFSTI

Research progress is reported on preparation of thorium and other reactor materials, phase studies of rare earths and refractory metal systems, and properties of reactor materials at high temperatures.
NSA

N70-38554# United Kingdom Atomic Energy Authority, Harwell (England).
DISPOSAL OF NOBLE GAS FISSION PRODUCTS FROM THE REPROCESSING OF NUCLEAR FUEL
H. J. Dunster Jan. 1970 30 p refs Presented at IAEA meeting on Noble Gas Fission Prod. in the Nucl. Ind., Paris, Oct. 1969
(AHSB(RP)R-101; Conf-691039-1) Avail: AEC Depository Libraries; HMSO: 5s; BIS $1.00

The radiological effects, local, national, and worldwide, of the release Kr-85 from reprocessing plants are considered in relation to a UK national power programme and predictions of the world growth of nuclear power. The status of the UK work on Kr-85 removal and storage is reviewed and extrapolated to the programmes predicted to the year 2000. The review confirmed earlier UK assessments that national and worldwide radiation doses will not pose any significant problems until well into the 21st century, by which time the annual genetic dose from 0.1 will probably be approaching 1% of the natural background dose rate of 0.1 rads/yr. It is demonstrated that there is good ground for confidence in the ability to extract the noble gases from the gaseous effluent from reprocessing plants when the need arises, and for the belief that the long-term storage of Kr-85 will not pose insuperable technical problems.
Author (NSA)

N70-38557# Douglas United Nuclear, Inc., Richland, Wash.
CONTROL OF FISSILE RADIOACTIVE MATERIAL
Jun. 1969 14 p refs Revised
(DUN-1100-Rev-1) Avail: CFSTI

Instructions for control of fissile radioactive materials are presented. Definitions and references are included along with information on procedures for shipping, receiving, posting and labeling, and transferring fissile radioactive materials.
NSA

N70-38579# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Inst. fuer Reaktortechnik.
DEVELOPMENT TENDENCIES IN CONSTRUCTION OF LARGE PRESSURE VESSELS FOR NUCLEAR REACTORS [ENTWICKLUNGSTENDENZEN IM BAU GROSSER DRUCKBEHAELTER FUER KERNREAKTOREN]
K. Schlosser Apr. 1970 20 p refs In GERMAN Submitted for publication
(SGAE-RT-30/1970) Avail: CFSTI

Fabrication of large thick-walled pressure vessels for nuclear

reactors demands exact procuction methods and quality controls, as well as safety measures that limit the dynamic pressure increase and secure the evacuation of after-fission heat. On site assemblies of band-reinforced steel pressure vessels and multiple layer construction seem to be the most effective pressure vessel manufacturing methods. Transl. by G.G.

N70-38592 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Sektor Elektronik.
REPORT ON INVESTIGATIONS OF RADIATION RESISTANCE OF THE RTL-INTEGRATED CIRCUIT FBH 162 [BERICHT UEBER STRAHLENRESISTENZUNTERSUCHUNGEN AM RTL-SCHALTKREIS FBH 162]
A. Spencker and J. Siegel Mar. 1970 35 p In GERMAN; ENGLISH summary
(HM-B-92; BEW-23) Copyright. Avail: Issuing Activity

The FBH 162 integrated circuit represents two NOR gates with two inputs each. Changes of the physical properties of individual devices and of signal transmission properties of the entire integrated circuit by means of 100 kV X-ray radiation, Co(60) X-ray radiation, 1.5 MeV electron radiation, and reactor neutron radiation are investigated. Corresponding to the increasing base recombination currents of the integrated circuit transistors, the different types of radiation damage are discussed. Decrease of transistor current gain below B - 12 marks the end of the integrated circuit function. Author

N70-38600# Argonne National Lab., Ill.
A VERTICAL SUBASSEMBLY ASSEMBLER-DISMANTLER FOR THE FUEL CYCLE FACILITY, EBR-2 PROJECT
W. L. Sales, D. L. Mitchell, J. R. White, and J. P. Simon Jan. 1970 23 p refs
(Contract W-31-109-eng-38)
(ANL-EBR-10) Avail: CFSTI

A change in the program of Experimental Breeder Reactor 2 from a power demonstration reactor to a fast-flux irradiation facility necessitated a corresponding change in the capabilities of the adjoining Fuel Cycle Facility (FCF) for handling irradiated subassemblies. A new vertical assembler-dismantler capable of handling experimental subassemblies was designed, constructed, and installed in the FCF air cell to replace existing equipment for assembling and disassembling driver-fuel subassemblies. This machine was installed remotely with a minimum of interruption of normal cell activities. Performance of the new machine has met all design requirements adequately. Author (NSA)

N70-38626# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SODIUM TECHNOLOGY Quarterly Report, Jan. - Mar. 1970
Apr. 1970 116 p refs
(Contract AT(45-1)-1830)
(BNWL-1200-3) Avail: CFSTI

Programs related to the control of coolant quality for the FFTF are described. Topics discussed include: Na system chemistry; Na coolant studies; Na analysis; Na system engineering; and oxygen-sensing solid electrolytes. NSA

N70-38656# Reactor Instituut, Delft (Netherlands)
REACTOR INSTITUTE Annual Report, 1968 1969 [REACTOR INSTITUUT JAARVERSLAG, 1968 1969]
Oct. 1969 69 p In DUTCH
(NP-18092) Avail: AEC Depository Libraries

Training courses were held in the fields of neutron physics, reactor physics, core shielding, nuclear chemical technology and the medical application of isotopes. The research carried out included development of a cold neutron source, improvement of techniques for measuring the Mossbauer effect and new instrumentation for the study of ion mobility. The spectroscopy of thermal and fast neutrons and the performance of the reactor were improved. The radiation chemistry group studied problems of ion mobility and stability, compared the effects of ultraviolet and gamma radiations and provided irradiation services for others. Activation analyses for mercury in pesticides and soils were automated. The ion exchange capacity peat and clay was determined for subsequent use in decontamination studies. Tracer studies were carried out for biological, industrial and agricultural applications. The health physics experiments included dosimetric investigations, dispersion of aerosols and the development of windowless counters. NSA

N70-38695# Scientific Translation Service, Ann Arbor, Mich.
THE S SUB N APPROXIMATION OF THE TRANSPORT EQUATION FOR SHIELDING A NUCLEAR REACTOR
J. Burian [1969] 26 p refs Transl. into ENGLISH from the Czech. Acad. of Sci. Rept. UJV-2125-R Prepared for Oak Ridge Natl. Lab., Tenn.
(ORNL-tr-2304) Avail: CFSTI

SUNSPHER and SUNCYL computer programs are described which calculate neutron fluxes in multilayer shields of nuclear reactors by Carlson S sub n approximation. In spherical geometry the degree of expanding the flux is variable as well as the degree of anisotropic scattering. In cylindrical one dimensional geometry the anisotropic scattering in transport approximation is supposed and the degree of angular terms is variable. Input, output and an example of calculation are shown. The codes are in Algol language for the GIER computer. Author (NSA)

N70-38701# Research Inst. of National Defence, Stockholm (Sweden).
SOME VIEWPOINTS ON THE INTERPRETATION OF RADIOGRAPHS [NAGRA SYNPUNKTER PA UTVARDERING AV RADIOGRAFIER]
Nils Gylden, Borje Andersson, and Gunnar Andersson Apr. 1969 16 p In SWEDISH
(FOA-2-C-2307-25) Avail: AEC Depository Libraries

Factors which determine the rate of exposure of radiographic film were studied. The investigation was especially concerned with finding data for precise positioning of the subjects to be radiographed with the aid of a photometer. Different evaluation methods were compared, and it was found that a properly designed photometer system can reduce certain measuring errors considerably (by a factor of 2 to 5). Author (NSA)

N70-38743# Oak Ridge National Lab., Tenn. Technical Information Div.
DEVELOPMENT WORK ON REPROCESSING OF THORIUM NUCLEAR FUELS [NUKLEAR-CHEMIE UND METALLURGIE GmbH]
Wolfgang bei Nanau 30 Jun. 1968 11 p refs Transl. into ENGLISH from German report
(ORNL-tr-2302; Rept-3) Avail: CFSTI

A furnace for combustion of spheres was constructed and tested in several experiments totalling 40 hr. It was found that graphite spheres can be burned in a shaft furnace in a stream of oxygen. Ninety percent of the total carbon is burned. By an afterburning process the carbon content of the ash is reduced to less than 0.5%. Results with graphite-coated ThO2-UO2 particles are reported. NSA

N70-38744# DuPont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

COBALT 60 POWER AND HEAT SOURCES Quarterly Progress Report, Oct. – Dec. 1969
C. L. Angerman and C. P. Ross, comps. Mar. 1970 23 p refs
(Contract AT(07-2)-1)
(DP-1226) Avail: CFSTI

High reaction rates between cobalt metal and the capsule walls observed in two capsules containing radioactive cobalt metal were caused by NaOH residue on the cobalt wafers. Heating for 10,000 hr at 1000 C was completed on radioactive capsules of Inconel 600, Hastelloy C, and Hastelloy X. Minor amounts of Co-60 were released when a capsule with an intentional defect was heated for 5000 hr at 1000 C. Fabrication processes were established for wafers of CoO, Co.5, Mg.050, and $CoAl_2O_4$, and irradiation of 120 wafers of each compound was begun. High activity cobalt metal is being produced for experimental purposes and the AEC's Co-60 loan program. Author (NSA)

N70-38752 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF LEAD IN THE DISCHARGE SYSTEMS OF SODIUM-COOLED REACTORS
V. M. Shirin et al [1970] 17 p refs Transl. into ENGLISH from Russian paper IAEA-SM-130/67 In ENGLISH and RUSSIAN (NLL-RISLEY-Trans-1934-(9091.9F); IAEA-SM-130/67) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The results of using molten lead to wash assemblies extracted from sodium and of determining the amount of sodium and lead remaining on the surfaces of the assemblies after recovery are presented. The effect of lead on the airtightness of assembly elements stored in lead jackets is determined. It is shown that lead does not deteriorate the hermetic seal of the assembly. Outgassing of fission products from leaking fuel elements through lead is investigated. It is shown that there is no outgassing through solidified lead, while molten lead has practically no effect in retaining the escaping gas from the fuel element. Author

N70-38765 Arizona Univ., Tucson.
NONLINEAR OSCILLATIONS AND STABILITY OF A NUCLEAR REACTOR WITH TWO REACTIVITY FEEDBACKS
Theodore Reinold Schmidt, Jr. (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18389

The autonomous nonlinear differential equations describing the dynamic behavior of nuclear reactors with two reactivity feedbacks are analyzed for stability and for the possibility of nonlinear oscillatory solutions. Fourier series expansions of the reactivity and power are used to search for limit cycles, successive approximations being generated by starting from the linear results. In this study, higher approximations including feedback from higher harmonic frequencies are derived for not only the amplitude of the reactivity but also the amplitude of the power. The effective lifetime model and the prompt jump approximation with one group of delayed neutrons are the two models used for the neutron kinetics. This permits an analysis of the effect of delayed neutrons on oscillations since both models are the same for small amplitude low-frequency oscillations. The most general linear heat transfer equations for two regions are described and the linear transformation for decoupling the equations is derived. Dissert. Abstr.

N70-38770# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
FAST BREEDER REACTOR CONTROL, SHIELD, AND REFLECTOR MATERIALS DEVELOPMENT Summary Report
Robert Van Houten Feb. 1970 94 p refs
(Contract AT(40-1)-2847)
(GEMP-723) Avail: CFSTI

A new diffusion couple test specimen design was developed, evaluated, and found acceptable. The design incorporates a hermetically sealed, thin-walled cylinder of the cladding alloy wafers of varying thicknesses to permit identification of reservoir related diffusion-couple effects. The capsule is then maintained at external pressures of as much as 2.8 kg/sq mm to ensure continuing firm contact of uncontaminated diffusion couple interfaces. Four high-pressure test furnaces, each capable of providing identical pressure-temperature exposures to from 50 to 150 test specimens, were made available to this program. Test specimen compositions include: B4C vs 315 SS, BN vs 316 SS, Ta vs 316 SS, and Ta vs Mo. Preliminary Bn-316 SS diffusion couple test specimens showed excellent stability. Preliminary Ta-Mo diffusion couple test specimens showed excellent stability. Since Ta and Mo have substantially equal thermal coefficients of expansion, Mo-clad Ta is expected to exhibit excellent operational stability. Author (NSA)

N70-38825# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
PULSED THERMONUCLEAR REACTOR OPERATED WITH LASERS [MIT LASERN BETRIEBENER GEPULSTER THERMONUKLEARER REAKTOR]
Wolfgang Kaiser et al 7 Jan. 1969 12 p Transl. into ENGLISH from German Patent Appl. no. 1900524, 7 Jan. 1969, 12 p
(AEC-tr-7148) Avail: CFSTI

A reactor employing LiD or LiT fuels, using a high power laser beam for excitation, is described. The advantages of the system are discussed. NSA

N70-38852 National Lending Library for Science and Technology, Boston Spa (England).
MELTING PHENOMENA IN UO2 IRRADIATION SAMPLES [SCHMELZPHAENOMENE IN UO2 BESTRAHLUNGSPROBEN]
D. Geithoff 1970 35 p refs Transl. into ENGLISH from German report KFK-980, May 1969 In ENGLISH and GERMAN
(NLL-WINDSCALE-Trans-423-(9091.9F)); KFK-980) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The melt cavities and the ceramic structure were observed in a series of oxide fuel test specimens which were partially melted under irradiation. X-ray radioscopy with a betatron was used to study the melt cavities. It is shown that the shape of the cavity is dependent on the type and duration of irradiation. Typical shapes were observed for long term, short term, and cycled irradiation. The ceramographic definition of the melt boundary in a fuel cross section was determined by using beta-gamma autoradiography and the cavity projection. Information concerning the flow behavior of melted uranium dioxide may also be gained from ceramic polished specimens. Author

N70-38860 National Lending Library for Science and Technology, Boston Spa (England).
OPERATIONAL EXPERIENCE WITH THE AVR (WEST GERMAN EXPERIMENTAL REACTOR ASSOCIATION REACTOR AND ITS APPLICATION TO THE THTR
W. Cautius 1970 20 p Transl. into ENGLISH from Energ. Tech. (West Germany), v. 21, Sep. 1969 p 350 - 356
(NLL-CE-Trans-5381-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The commissioning phases and the first 18 months' operation of the AVR with details of all faults and simulated faults are reported. Including scheduled shutdowns, the availability of the reactor was 54% with 54 million kw-h supplied to the grid. Special attention is given to fueling aspects. Coated particles have replaced the earlier noncoated variety, making the complex sealing systems of the reactor redundant. Such systems are being omitted from the THTR reactor since they reduce the availability. Author

N70-38902 National Lending Library for Science and Technology, Boston Spa (England).
STUDIES ON REMOVAL OF RADIO-IODINE BY ACTIVATED CARBON, 1. ADSORPTION OF IODINE AND METHYLIODIDE ON ACTIVATED CARBON
Toshifumi Murata et al 9 Apr. 1970 16 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 11, no. 3, 1969 p 138 - 145 In ENGLISH and JAPANESE
(NLL-WINDSCALE-Trans-408-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy coupons

Iodine or methyl iodide with He gas serving as the carrier were passed through various types of activated carbons. The absorption rates, saturated adsorption amounts, heats of adsorption and desorption were found by gamma ray determination of radioactive iodine 131. Author

N70-38923 National Lending Library for Science and Technology, Boston Spa (England).
BURST CAN DETECTION IN A HEAVY WATER MODERATED REACTOR
J. Grisollet et al 2 Apr. 1970 10 p Transl. into ENGLISH from Energie Nucl. (Paris), v. 10, Dec. 1968 p 502 - 505
(NLL-CE-Trans-5240-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The data processing by a computer associated with the Burst Can Detection (BCD) system in a heavy water moderated reactor is examined. Continuous monitoring of BCD and other functions associated with the evaluation of thresholds and the preset order of sampling are reported. Author

N70-38961# Battelle-Northwest, Richland, Wash. Reactor Physics Dept.
REACTOR PHYSICS Quarterly Report, Jan. - Mar. 1970
May 1970 114 p refs
(Contract AT(45-1)-1830)
(BNWL-1381-1) Avail: CFSTI

Progress is reported on reactor theory and code development, radioactive isotope decay in thermal reactors, and nuclear and physical studies on fast reactors. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-37699# RAND Corp., Santa Monica, Calif.
EFFECT OF EXCHANGE ON MAGNETOSTATIC MODES
M. Sparks Apr. 1970 9 p refs
(AD-707011; P-4367) Avail: CFSTI CSCL 20/3

When surface spin pinning is included in the thin-film magnetostatic-mode eigenvalue problem, exchange must be included even when the exchange energy is negligible. The magnetization is changed drastically in general, but the intensities and frequencies are essentially the same as for the pure magnetostatic modes (exchange constat D = 0 and no explicit pinning mechanism). Author (TAB)

N70-37741# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF DATA TRANSMISSION THROUGH MEDIA OF VARIOUS DENSITIES BY ACOUSTIC MEANS
Raymond Burke Wellborn (M.S. Thesis) Oct. 1969 70 p refs
(AD-706722) Avail: CFSTI CSCL 20/1

Ultrasonic transducers were used to couple the transmission of continuous-wave and pulse-modulated signals across relatively short paths of less than one meter through media of various densities. The experimental model used consisted of two concentric, cylindrical, stainless-steel tanks, one inside the other, with the area between them filled with either water or air. The investigation showed the feasibility of transmitting usable data to and from a unit which was isolated from a data source, i.e., from outside the outer tank to inside the inner tank, and vice versa, without physically penetrating the walls of either tank. An application hypothesis for a Submarine Launched Weapon System is presented as an example of employment of this technique since the weapon vehicle is relatively isolated from the fire-control system and since the elimination of cabling between the launcher and the weapon should enhance system performance. Author (TAB)

N70-37769# California Univ., Berkeley. Lawrence Radiation Lab.
THEORETICAL FOUNDATIONS OF NATURAL AND MAGNETICALLY-INDUCED OPTICAL ACTIVITY
David Ernest Downie (Ph.D. Thesis) Mar. 1970 380 p refs
(Contract W-7405-eng-48)
(UCRL-19751) Avail: CFSTI

A general theory of natural and magnetically induced optical activity is developed. Included in the analysis are mathematical phenomena, determinations of vibrational and symmetrical patterns, and the electronic structures of some molecules. E.H.W.

N70-37800# Houston Univ., Tex. Wave Propagation Labs.
DETERMINATION OF MICROSCALE ROUGHNESS OF CYLINDRICAL SURFACES USING ULTRASONIC CREEPING WAVES
H. S. Hayre and G. Vroulis 1969 6 p refs Submitted for publication
(Contract Nonr-4492(02))
(AD-707286; TR-69-7) Avail: CFSTI CSCL 14/2

The circumferential waves or creeping waves propagate in both media separated by a rough interface in an alternating fashion, and are reviewed from a theoretical point of view; the associated velocity of propagation dependence on the interface surface roughness is shown to be reasonably valid for microscale roughness determination. Experimental results are also included to support theory, and certain empirical relationships are derived as an example of the application of the technique. Author (TAB)

N70-37818 Pittsburgh Univ., Pa.
NOISE CHARACTERIZATION OF TWO-PORT NETWORKS BY CORRELATION TECHNIQUES
William Richard Huber (Ph.D. Thesis) 1969 231 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 69-18382

A measurement method based on the time domain quantities of noise generator auto- and cross-correlation is developed. Using this method with presently available equipment, direct measurements of ENG magnitudes and correlation coefficient over a two decade frequency band can be obtained with just four measurements. A computer program is described which performs fast-Fourier transformations on the measured correlation functions, converts to the input ENG set by using the equations developed herein, and computes optimum noise figure, otpimum source impedance, and other noise parameters. Actual noise measurements by the time domain method are presented for representative transistors, and compared to measurements by standard frequency-domain techniques. Excellent agreement is obtained for optimum noise figure, and some interesting correlation coefficient behavior is observed at low frequencies. Dissert. Abstr.

N70-37820# California Univ., Berkeley. Lawrence Radiation Lab.
VAPORIZATION MECHANISM OF ICE SINGLE CRYSTALS
John Gordon Davey (Ph.D. Thesis) Dec. 1969 72 p refs
(Contract W-7405-eng-48)
(UCRL-19133) Avail: CFSTI

The effects of various experimental parameters such as crystal orientation, doping with impurities and adsorbed gases on the ice vaporization kinetics are presented and discussed. Neither grain boundaries nor crystalline orientation has a measurable effect on the rate. Ice doped with monovalent impurities was found to vaporize at steady-state rates that were uniformly lower over the entire temperature range of the study. Also, NH3(gas) and HF(gas), present in the ambient at pressures approximately .00 to 0.01 torr, reduce and increase respectively the ice vaporization rate compared to the rate in vacuum. The experimental results, along with previously reported physical-chemical properties of ice are used to arrive at a vaporization mechanism: Ice at equilibrium with the vapor has a uniform surface population of a highly mobile species assumed to be water molecules hydrogen-bonded to only one nearest neighbor. At sufficiently low temperature, vaporization does not occur rapidly enough to alter this population. Sublimation at higher temperatures depletes the population to a progressively greater extent with increasing temperature. The rate limiting step in vaporization, changes to their formation at high temperatures.
NSA

N70-37907 Rice Univ., Houston, Tex.
THE EFFECT OF SURFACE ROUGHNESS ON THE RADIATIVE PROPERTIES OF ABSORBING AND EMITTING MEDIA
Alexander Samuel Adorjan (Ph.D. Thesis) 1969 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-19263

An analytical study is presented on the effect of surface roughness on the radiative properties of an absorbing plate. The plate is isothermal and infinite in extent, with sinusoidal roughness on the boundary surfaces and irradiated by plane monochromatic waves. Transmittance and emittance of the plate is determined for normal irradiance. Governing relations for the interior of the plate are the transport equations. For boundary conditions, the reflectance and transmittance at the interface are obtained by the solution of Maxwell's equations. It is found that both the transmittance and the emittance of the plate exhibit a maximum near the point where the pitch of the surface roughness is the same as the wavelength of the radiation. This interval is called transition region because the surface changes from specular to diffuse. If the pitch is smaller than the wavelength, the properties approach those of an optically flat plate. At the other extreme, the properties correspond to those of a diffuse plate. Results indicate that radiative properties are influenced by both the pitch and amplitude of the roughness.
Dissert. Abstr.

N70-37988# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
A MEASUREMENT OF THE DEFLECTION OF 9.602-GHz RADIATION FROM 3C279 IN THE SOLAR GRAVITATIONAL FIELD
G. A. Seielstad, R. A. Sramek, and K. W. Weiler 1970 17 p refs
(Contract N00014-67-A-0094-0008; Grant NSF GP-15271)
(AD-706311; Rept-1970-4) Avail: CFSTI CSCL 20/10

During its occultation by the sun in October 1969, the position of the radio source 3C279 was interferometrically monitored to determine the deviation of its 9.602-GHz radiation in the solar gravitational field. Rapid instrumental calibration and negligible coronal diffraction enabled the measurement of a General Relativity deflection of 1.77 plus or minus 0.20 seconds at the limb of the sun. This is in close agreement with Einsteins prediction.
Author (TAB)

N70-37999# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
THEORETICAL PREDICTION OF ACOUSTIC-GRAVITY PRESSURE WAVEFORMS GENERATED BY LARGE EXPLOSIONS IN THE ATMOSPHERE Final Report, 1 Feb. 1967 - 31 Jan. 1970
Allan D. Pierce and Joe W. Posey 30 Apr. 1970 298 p refs
(Contract F19628-67-C-0217)
(AD-707122; AFCRL-70-0134) Avail: CFSTI CSCL 18/3

A computer program is described which enables one to compute the pressure waveform at a distant point following the detonation of a nuclear explosion in the atmosphere. The theoretical basis of the program and the numerical methods used in its formulation are explained; a deck listing and instructions for the programs operation are included. The primary limitation on the programs applicability to realistic situations is that the atmosphere is assumed to be perfectly stratified. However, the temperature and wind profiles may be arbitrarily specified. Numerical studies carried out by the program show some discrepancies with previous computations by Harkrider for the case of an atmosphere without winds. These discrepancies are analyzed and shown to be due to different formulations of the source model for a nuclear explosion. Other numerical studies explore the effects of various atmospheric parameters on the waveforms. In the remainder of the report, two alternate theoretical formulations of the problem are described. The first of these is based on the neglect of the vertical acceleration term in the equations of hydrodynamics and allows a solution by Cagniards integral transform technique. The second is based on the hypothesis of propagation in a single guided mode and permits a study of the effects of departures from stratification on the waveforms.
Author (TAB)

N70-38012 National Lending Library for Science and Technology, Boston Spa (England).
VARIATION OF RETENTION TIME WITH SAMPLE SIZE ON MICROPOROUS POLYMER COLUMN
L. Eek et al 24 Jun. 1970 5 p refs Transl. into ENGLISH from Chromatographia (Brunswick), 1969
(NLL-M-9236-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The effect of the amount of injected sample on the retention time of various substances in columns of microporous polymers (PorapakQ, Chromosorb 101, Chromosorb 102) was examined. Retention time decreases when sample size increases, but the point where the tail of the peak and the base line intersect does not depend on the injected mg, and this fact allows the identification of a given substance. It is pointed out that this peculiarity is due to adsorption as occurs with typical adsorbents.
Author

N70-38068# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE REFLECTANCE OF A LIGHT DIFFUSER WITH NONUNIFORM ABSORPTION
Tung-Po Lin and Hung-Kuen A. Kan 15 Apr. 1970 28 p refs
(Contract F04701-69-C-0066)
(AD-707516; TR-0066(9250-04)-1; SAMSO-TR-70-192) Avail: CFSTI CSCL 20/6

The total reflectance of a light diffuser with nonuniform absorption is considered in the two-beam model. A series solution is obtained for the Kubelka-Munk equations, which describe an opaque layer characterized by a constant scattering coefficient and an absorption coefficient with an exponential distribution. Numerical results are graphically shown and application to photochemical studies are discussed. An analytic solution is given for a special composite diffuser that has a uniform layer of finite thickness on its surface.
Author (TAB)

N70-38120# Toronto Univ. (Ontario). Inst. for Aerospace Research.
A COLLISIONAL TREATMENT OF THE REFLECTION OF AN IMPLODING HEMISPHERICAL SHOCK WAVE.USAF/ARL, NRC
A. K. Macpherson *In its* [Inst. for Aerospace Res.] Nov. 1969 p. 25 (See N70-38116 21-01)
Avail: CFSTI

The reflection of a hemispherical imploding shock wave was studied in the region very close to the centre. Two aspects which were of particular interest were the effects of the presence of a cold wall and the effects of performing the experiment in a very dense gas. A Monte Carlo technique substantially as proposed by Bird was used to examine the difference between a specularly reflecting wall and a cold wall. The implosion in a dense gas was simulated numerically by considering the first terms of a Taylor series expansion of the position and velocity vectors. The interparticle potential law was a combination of the Thomas-Fermi-Dirac and Lennard-Jones laws as proposed by Redhead, Hobson and Kornelsen. However, as this latter technique is still under development, the results can only be proposed tentatively. Author

N70-38263# National Bureau of Standards, Washington, D.C.
A CRYOSCOPIC STUDY OF THE SOLUBILITY OF URANIUM IN LIQUID SODIUM AT 97.8 C
Thomas B. Douglas *In its* Precision Meas. and Calibration Feb. 1970 p 153-156 refs Submitted for publication Supported in part by AEC (See N70-38251 21-33)
Avail: SOD $5.00

The equilibrium temperatures, at various stages of melting, of three samples of sodium were measured with a standard deviation of 0.001 degree. One sample contained uranium in compact form, and one contained finely divided uranium. Impurities lowered the freezing points of all the samples by approximately 0.035 degree, but the sodium containing finely divided uranium was found to have a freezing point higher than those of the other two samples by 0.005 degree, an effect that may be due to a partial purification of the sodium by the uranium. After extrapolation to no impurity, the freezing points of the three samples agree within 0.001 degree. Allowing for errors, it is concluded that the solubility of uranium in liquid sodium at 97.8 C probably does not exceed 0.05 percent by weight and may actually be many times smaller. Author

N70-38269# National Bureau of Standards, Washington, D.C.
THE VAPOR PRESSURE, VAPOR DIMERIZATION, AND HEAT OF SUBLIMATION OF ALUMINUM FLUORIDE, USING THE ENTRAINMENT METHOD
Ralph F. Krause, Jr. and Thomas B. Douglas *In its* Precision Meas. and Calibration Feb. 1970 p 227-233 refs Submitted for publication (See N70-38251 21-33)
(Contract AF-AFOSR-ISSA-65-8; ARPA Order 20)
Avail: CFSTI

The vapor pressure P of anhydrous aluminum fluoride was measured at eight temperatures between 1194 and 1258 K by an entrainment method. The standard deviation of P from a least-square fit was 0.15%, and possible systematic errors of 0.5% in P and 1 deg in T were estimated. Smoothed values of P and dP/dT at 1225 K were determined. Considering P as the sum of the ideal monomeric and twice the dimeric vapor pressure, the other two thermodynamic properties necessary to define were dervied from published spectroscopic and crystalline heat capacity data. The derived results at 1225 K along with their estimated uncertainties were delta H deg(1) = 67.0 + or - 0.4 kcal, delta S deg(1) = 43.0 + or - 0.4 eu, and delta G deg(2) = -7 + or - 1 kcal. Author

N70-38271# National Bureau of Standards, Washington, D.C.
HEAT OF ISOMERIZATION OF THE TWO BUTADIENES
Edward J. Prosen, Frances W. Maron, and Frederick D. Rossini *In its* Precision Meas. and Calibration Feb. 1970 p 262-270 refs Submitted for publication (See N70-38251 21-33)
(NBS-RP-1968) Avail: CFSTI

The heat of isomerization of 1,3-butadiene to 1,2-butadiene, in the gaseous state at 25 C was determined by measurement of the ratio of their heats of combustion in oxygen to form carbon dioxide and water. The combustion of the gaseous hydrocarbon occurred in a flame at constant pressure in a glass calorimetric reaction vessel of improved design. A complete description of the new calorimetric reaction vessel is given. Using the value for the heat of formation of 1,3-butadiene previously reported, the calculated values are given for the reactions of formation and combustion of 1,2-butadiene. Author

N70-38272# National Bureau of Standards, Washington, D.C.
HEATS OF FORMATION OF DIBORANE AND PENTABORANE
Edward J. Prosen, Walter H. Johnson, and Florence Y. Pergiel *In its* Precision Meas. and Calibration Feb. 1970 p 271-274 refs Submitted for publication (See N70-38251 21-33)
(NBS-RP-2901) Avail: SOD $5.00

The heats of formation of diborane and pentaborane have been determined by measurements of the heats of decomposition into amorphous boron and hydrogen in a calorimeter. The heats of formation at 25 C, from amorphous boron and hydrogen, are 6.73 + or - 0.52 kcal/mole for diborane (gas) and 12.99 + or - 0.39 for pentaborane (gas). Author

N70-38274# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
CONSTANT PRESSURE FLAME CALORIMETRY WITH FLUORINE. 2: THE HEAT OF FORMATION OF OXYGEN DIFLUORIDE
Reatha C. King and George T. Armstrong *In its* Precision Meas. and Calibration Feb. 1970 p 288-306 refs Submitted for publication (See N70-38251 21-33)
(Contract AF-AFOSR-ISSA-65-8)
Avail: SOD $5.00

The heats of the following reactions were measured directly in an electrically calibrated flame calorimeter operated at one atm pressure and 303 K. $OF_2(g) + 2H_2(g) + 99H_2O(l)$ yields $2[HF \cdot 50H_2O](l)$ $F_2(g) + H_2(g) + 100H_2O(l)$ yields $2[HF \cdot 50H_2O](l)$ $0.5O_2(g) + H_2(g)$ yields $H_2O(l)$ The reactants and products were analyzed for each of the reactions. From these heats the corresponding heats of formation were calculated. Author

N70-38295# Wyle Labs., Inc., Huntsville, Ala.
INVESTIGATION OF ANOMALOUS BEHAVIOR OF SOUND ABSORPTION BY MOLECULAR RELAXATION
L. B. Evans and L. C. Sutherland May 1970 34 p refs
(Contract DAHC04-69-C-0088)
(AD-706844; WR-70-4; AROD-8725-1-E) Avail: CFSTI CSCL 20/1

Experimental measurements of the absorption of sound in still air exhibit a distinct deviation from the theoretical predictions based on known classical and molecular relaxation absorption losses. Investigation of published laboratory data has verified that Knesers theory for molecular relaxation accurately describes the absorption loss near and above the relaxation frequency. At frequencies less than about 0.1 of the relaxation frequency, a different mechanisms becomes predominant and results in an absorption loss component which varies directly with the frequency and is essentially independent of humidity. The objective of the effort in this contract is to carry out a detailed experimental and analytical investigation of this anomaly to allow numerical calculations to be made of air absorption for a variety of atmospheric conditions in still air. Author (TAB)

N70-38338# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

THE TRAPPING OF ACOUSTICAL ENERGY IN AN INFINITELY LONG JET

E. W. Graham and B. B. Graham Mar. 1970 33 p refs
(AD-706475; D1-82-0947) Avail: CFSTI CSCL 20/1

The mean-square pressure far downstream in the jet (considered as an index of trapped energy) is determined for a two-dimensional source in a two-dimensional jet of infinite length. Jets having shear layer boundaries and velocity discontinuity boundaries are considered. Results from the particular examples chosen suggest that in certain frequency bands this trapped energy in the infinitely long jet is significant. Author (TAB)

N70-38453# Grumman Aircraft Engineering Corp., Bethpage, N.Y. System Sciences Section.

SCATTERING OF A HORIZONTALLY POLARIZED SURFACE WAVE BY A SEMI-FINITE GROUNDED DIELECTRIC SLAB. PART 1: MODAL REPRESENTATION AND VARIATIONAL TECHNIQUE

R. Larsen Aug. 1970 116 p refs
(RE-390-Pt-1) Avail: CFSTI

Modal analysis and synthesis combined with a variational technique is used in this report to obtain an approximate solution for the scattering of a horizontally polarized (TE) surface wave from a semi-infinite grounded dielectric slab. The given nonuniform structure is considered to be composed of two uniform waveguides joined together at the plane in which the dielectric slab is abruptly terminated. The complete modal spectrum is then derived for each waveguide region. This work is substantially self-contained in that one dimensional representation theory is reviewed and extended to the geometry under consideration. The integral equations for the electric and magnetic fields in the plane of the discontinuity are utilized to set up variational expressions for the terminal impedance, representing the effect of the discontinuity on the incident surface wave. The variational formulas derived in this study are then used to find the electromagnetic field scattered by the end of the dielectric slab. Author

N70-38487# International Centre for Theoretical Physics, Trieste (Italy).

S-MATRIX FOR GAUGE-INVARIANT FIELDS

E. S. Fradkin (Lebedev Inst. of Phys., Moscow) and I. V. Tyutin (Lebedev Inst. of Phys., Moscow) Jan. 1970 53 p refs
(IC/70/1) Avail: CFSTI

A method is suggested for constructing the generating functional (S-matrix) for fields possessing an invariance group and is applied to the Yang-Mills field and to the gravitational field. The unitary and gauge-independence of the S-matrix on the mass shell is seen explicitly. Author (ESRO)

N70-38548# Ohio State Univ., Columbus. ElectroScience Lab.

A HIGH FREQUENCY APPROXIMATION FOR THE STRIP CURRENT Scientific Interim Report

John Freeland, Robert G. Kouyoumjian, and Prabhakar H. Pathak 23 Mar. 1970 52 p refs
(Contract AF 19(628)-5929)
(AD-707107; AFCRL-69-0400; SR-1; Rept-2183-5) Avail: CFSTI CSCL 20/3

The currents on a perfectly conducting strip illuminated by a plane wave are considered. A high frequency, approximate solution is obtained by using the exact half plane currents and employing symmetry conditions, edge conditions, continuity conditions, and the high frequency behavior of the current. The approximate currents are found to agree well with the rigorously calculated currents if the strips are sufficiently wide. The far-zone scattering patterns calculated from the approximate currents are compared with rigorously calculated patterns and patterns calculated from the geometrical theory of diffraction (GTD). The approximate current patterns and the GTD patterns can be used to construct a pattern which is accurate at all aspects. The effect on the pattern of certain types of errors in the current is discussed. It is seen that a small, almost periodic error in the current may result in a large error in the pattern at certain aspects. Author (TAB)

N70-38571# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SUPERCONDUCTING MAGNETIC SYSTEMS: Selected Portions

E. Ya. Kazovskii et al. 24 Apr. 1970 69 p Transl. into ENGLISH from Nauka Leningr. Otd. (Leningrad), 1967 p 2 - 3 152 - 164
(AD-706800; FTD-MT-24-40-70) Avail: CFSTI CSCL 20/3

The book is dedicated to the application of the phenomenon of superconductivity in areas of heavy current electrical engineering and power engineering. Specific problems of designing superconducting magnetic systems are examined. The book contains much information on the mechanical, thermal, and electrical properties of different materials at low temperatures, on the relationships of cost of materials, on methods of obtaining helium temperatures etc. Author (TAB)

N70-38572# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

METHOD OF THE GENERATING FUNCTIONAL IN THE KINETICS OF THE WEAK NONUNIFORM STATES

V. V. Krasilnikov and V. D. Tsukanov 1969 25 p refs In RUSSIAN
(ITF-69-67) Avail: AEC Depository Libraries

The generating functional of mean values of the creation and annihilation operators of particles is introduced for the investigation of the kinetics of the weak nonuniform states. The functional equation for this functional is formulated substituting the Liouville equation for the density matrix. The integral equations for the first two terms of the generating functional expansion in gradient series are found for that stage of the evolution when the state of the system can be described by the single-particle density matrix. The integral equation for the hydrodynamic generating functional is obtained as well, and a solution of this equation in the first approximation by the density of particles of the system is found. By means of this solution, the kinetic equation for the linear distribution function was obtained by gradient approximation. Author (NSA)

N70-38580*# Eidgenossische Technische Hochschule, Zurich (Switzerland).

CALCULATION OF FOCAL POINT CHARACTERISTICS IN OPTICAL SYSTEMS THAT PRODUCE SPECIAL IMAGES, AS WELL AS FOR A THICK LENSE WITH TWO ASPHERICAL PLANES [BERECHNUNG DER BRENNPUNKTSCHARAKTERISTIKEN OPTISCHER SYSTEME, WELCHE SPEZIELLE ABBILDUNGEN VERMITTELN, SOWIE FUER EINE DICKE LINSE MIT ZWEI ASPHAERISCHEN FLAECHEN]

Werner Gehret (Ph.D. Thesis) 1969 120 p refs In GERMAN Supported in part by Natl. Fund of Switz.
(Diss-4343) Avail: CFSTI

Analytic aberration theory is used to develop the number of points, levels, and areas that can be imaged by an optical system and to obtain eikonal functions for these images up to the fifth power. Also determined are point characteristics and design data for a thick lens with two aspheric levels; point characteristics are normalized by transforming general characteristics of optical

path lengths from focal level to focal level. Obtained point damage characteristics are independent of the object surface as well as of lens aperture. Transl. by G.G.

N70-38672# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
TIME DELAY OF SCATTERING PROCESSES. PART 2: POLARIZATION DEPENDENCE
J. L. Agudin (Intern. Centre for Theoret. Phys.) Trieste Intern. Centre for Theoret. Phys. Jan. 1970 27 p refs Submitted for publication Sponsored in part by French Govt. Prepared jointly with Intern. Centre for Theoret. Phys.
(IC/70/6) Avail: CFSTI

An expression is derived for the time delay, t sub 1, of an electromagnetic wave in the total reflection case when the incident electric field is polarized parallel to the plane of incidence. It can be related to the time delay, t sub 2, for perpendicular polarization to give the relative time delay, t sub 1 − t sub 2. If an optical beam with its electric field polarized in a plane making a certain angle with the plane of incidence strikes the interface dielectric-vacuum at an angle equal to or greater than the critical one, it will be reflected in general as two beams polarized parallel and normal to the plane of incidence. The two reflected beams coincide for the angle used by Fresnel to produce circularly polarized light from initially linearly polarized light. Some effects in three-dimensional scattering problems and the optical model for high-energy collisions are also discussed. Author (ESRO)

N70-38698 Missouri Univ., Rolla.
A THEORETICAL STUDY ON THE INTERPRETATION OF RESISTIVITY SOUNDING DATA MEASURED BY THE WENNER ELECTRODE SYSTEM
Siew Hung Chan (Ph.D. Thesis) 1969 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-19427

The objectives are to derive from the apparent resistivity data some suitable functions from which the resistivity and thickness of each member of the sequence of layers composing the earth may be determined, and to devise suitable methods for analyzing the resulting functions. It is shown that the solution of the boundary value problem associated with an *n*-layered earth model leads to an integral equation for the Wenner electrode system. This integral equation relates the apparent resistivity function to a known function, termed the kernel, which is dependent on the layer resistivities and thicknesses. Formulas for numerical integration are developed for the calculation of both the kernel and associated kernel from apparent resistivity data. A numerical-graphical method is developed for the analysis of kernel and the associated kernel. A further technique based on the principle of logarithmic curve matching is developed for the decomposition of the kernel alone. Dissert. Abstr.

N70-38737# Saclant ASW Research Center, La Spezia (Italy).
EFFECT OF RAIN ON UNDERWATER NOISE LEVEL
N. Bom 15 Sep. 1968 33 p refs
(Saclantcen-TR-121) Avail: CFSTI

The underwater noise due to precipitation was measured in a small, shallow lake along with local wind speed, rain, atmospheric pressure and noise level. The noise due to wind and the contribution from bottom and boundary reflections had a negligible effect. The data in the interval 300–9600 Hz were analyzed in octave bands and an estimate of the average noise level versus rain rate was obtained. The results showed significantly higher noise levels and a difference in the shape of the noise level versus frequency curve compared with the laboratory studies of splashes as a source of sound. However, the average rate of change in noise level with change in rain rate was of the same order of magnitude. Author (ESRO)

N70-38768# Stanford Linear Accelerator Center, Calif.
A NEW PRECISION MEASUREMENT SYSTEM FOR BEAM TRANSPORT TYPE MAGNETS
J. K. Cobb and D. Horelick May 1970 14 p refs Presented at 3rd Intern. Conf. on Magnet Technol. Hamburg, 19-22 May 1970 Sponsored by AEC
(SLAC-PUB-750; Conf-700503-2) Avail: CFSTI

The applicability of magnetic spectroscopy to the general measurement of magnets, particularly beam transport magnets, is discussed. It is shown that the multipole strengths available from spectroscopy can be used directly in beam transport equations. Several systems for instrumenting magnetic spectroscopy are described. First, the conventional wave analyzer which is limited in accuracy and difficult to automate. Second, an incremental integrating approach which is appropriate for off-line Fourier analysis by computer; this approach has been tested. Last, a proposed on-line computer system is detailed which has the additional capabilities for on-line data processing and closed-loop current control. Such a system has flexibility and potential considerably beyond those of the other systems. Author (NSA)

N70-38787# Rensselaer Polytechnic Inst., Troy, N.Y.
COMPLETE FORCE BALANCING OF SPATIAL LINKAGES
Roger E. Kaufman and George N. Sandor [1969] 30 p refs
(Grant NSF G-1231)
Avail: Issuing Activity

A method is presented which permits the complete force balancing of spatial linkages such as the revolute-spherical-spherical-revolute and spatial slider-crank mechanisms. Operator equations are written describing the location of the center of mass for the given mechanism. The coefficients of the time-dependent terms are set to zero by properly locating the mass centers of selected links. As a result, the location of the total center of mass is invariant and there is no resultant shaking force. Author

N70-38795*# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
SMALL DEFLECTION OF A CLASS OF CLAMPED THIN PLATES USING CONFORMAL MAPPING
Will J. Worley and Thomas F. Moriarty Washington NASA Sep. 1970 37 p refs
(Grant NGR-14-005-010)
(NASA-CR-1657) Avail: CFSTI CSCL 20L

The small deflection behavior is presented for clamped flat plates having a boundary defined by an equation where the positive constants are not necessarily integers. The coefficients of the series representing the conformal mapping of the interior of the unit circle onto the interior of the given equation are applied to small deflection analysis of the plates. Author

N70-38798*# Bell Aerospace Co., Buffalo, N.Y.
INVESTIGATION OF THE INFLUENCE OF DUCT-MOUNTED HELMHOLTZ RESONATORS ON THE SOUND FIELD OF A MODEL DUCTED PROPELLER
David Brown NASA Sep. 1970 62 p refs
(Contract NAS1-8220)
(NASA-CR-1653) Avail: CFSTI CSCL 20A

An experimental investigation of the influence of wall-mounted Helmholtz resonators on the sound field of a ducted propeller is reported, with an objective of determining the feasibility of far field noise reduction. The investigation utilized two model propeller ducts, with an array of discrete resonator units installed at the wall surface. Preliminary measurements, with the resonators tuned to the propeller harmonics, indicated a significant increase in the far field signature. An analytical model, illustrating the effect of wall impedance on dispersive acoustic modes, was then derived. This

suggested a critical influence of the reactive impedance on the transmission loss (for a constant resistive impedance). Further experimental studies did not achieve the desired objective, but indicated the necessity for consideration of modal coupling, particularly to radial modes. Author

N70-38826# Transtek Associates, Reading, Mass.
METHOD FOR MEASURING MAGNETIC SURFACES USING A DIELECTRIC GRID
A. P. Popryadukhin Apr. 1970 14 p refs Transl. into ENGLISH from Akad. Nauk SSSR Preprint No. 108 In RUSSIAN and ENGLISH Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-101) Avail: CFSTI

The development of a fast method of recording surfaces also permits one to consider the problem of compensation for the most dangerous resonance perturbations of the field since it becomes possible operatively to control the shape of the surfaces after each change in amplitude and phase of the compensating harmonic of the magnetic field. NSA

N70-38905 Wisconsin Univ., Madison.
THE ORIGIN OF THE CONCEPTION OF THE CONTINUOUS SPECTRUM OF HEAT AND LIGHT
Robert James Mc Rae (Ph.D. Thesis) 1969 448 p
Avail: Univ. Microfilms: HC $20.25/Microfilm $5.70 Order No. 69-12397)

This historical analysis leads to the primary conclusion that the eventual formulation of the notion of a singular, undulatory spectrum was the result of a four-stage development from about 1835 to 1845 after more than three decades of uncertainty. Although solutions were being attempted continually on all aspects involved, no single issue was solved unambiguously until the precedent ones were settled satisfactorily. Thus, the first problem to be resolved was the recognition that thermal radiation was completely analogous to light for all properties such as reflection, refraction, and polarization. Secondly, a heterogeneity of rays comparable to the range of colors within white light was found to exist in a beam of radiant heat. Thirdly, in the range of joint refrangibilities, thermal and luminous effects were demonstrated to originate from one common cause, i.e., light was conceived as merely a limited range of thermal rays detected by the eye. Finally, the wave model was adopted as the superior conceptual mechanism to account for this singular set of rays. Dissert. Abstr.

N70-38930# Saclant ASW Research Center, La Spezia (Italy).
A SIMPLE AND ACCURATE FORMULA FOR THE CALCULATION OF THE VELOCITY OF SOUND IN SEA WATER
C. C. Leroy 1 Apr. 1968 35 p refs
(Saclantcen-TR-111) Avail: CFSTI

A formula for easy calculation of the velocity of sound in the ocean is presented. It has been developed to approach within 0.1 m/s of the values given by Wilson's second formula for most ocean cases. It uses depth instead of pressure as a parameter and is simple enough for the calculation to be made by hand. Author (ESRO)

N70-38973 Maryland Univ., College Park.
THE MASKING EFFECTS OF INTERRUPTED TONAL STIMULI UPON PURE TONES
Beth Janice Urban (Ph.D. Phesis) 1969 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-16612

The purposes of this study were to determine: (1) the threshold level for frequencies measured in quiet and for frequencies measured in the presence of a pure tone masking stimulus, 2) the frequency at which maximum masking occurred when a masking tone was presented simultaneously with another frequency, 3) the comparative amounts of masking produced by uninterrupted and interrupted tonal stimuli, 4) the masking effect of an interrupted signal in which the tonal duration was held constant and the duration of the interruptions was increased, and 5) the masking effect of an interrupted signal in which the duration of the interruptions was held constant and the tonal duration was increased. The subjects were ten adults with normal hearing. Results showed that when the frequencies of both the masker and the probe tone approached proximity, an interrupted masker generally produced greater masking than an uninterrupted pure tone masking source when presented at equal sound pressure levels. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-37641# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERCONDUCTIVITY IN THE QUARK MODEL AND REGGE TRAJECTORIES
Yu. M. Malyuta 21 Jan. 1970 8 p refs Transl. into ENGLISH from the Russian
(AD-706168; FTD-HT-23-463-69) Avail: CFSTI CSCL 20/8

It is shown that reggeons, representing two families of baryon resonances are the states of superconductive type, which are constructed of three quarks with zero masses. TAB

N70-37695# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
RESEARCH ON ELEMENTARY PARTICLES Final Scientific Report, Nov. 1968 - Sep. 1969
Abdus Salam and P. T. Matthews 3 Feb. 1970 10 p refs
(Grant AF-EOAR-0045-69)
(AD-706920; AFOSR-70-1488TR) Avail: CFSTI CSCL 20/8

The research work described in the report covers a large number of topics in the general field of theoretical elementary particle physics, including in particular Regge pole theory, current algebra, strong interaction dynamics and astrophysics. Author (TAB)

N70-37711# Brandeis Univ., Waltham, Mass. Dept. of Physics.
RESEARCH IN QUANTUM FIELDS, PARTICLE THEORY, AND GENERAL RELATIVITY Final Report
Stanley Deser 5 May 1970 15 p refs
(Grant AF-AFOSR-368-67)
(AD-706881; AFOSR-70-1130TR) Avail: CFSTI CSCL 20/10

Research under the grant was in two basic areas. In the first, Gravitation, three of the principal topics were (1) Proof of positive-definiteness of energy and timelike character of the four-momentum for any gravitational system either with normal material sources or source-free. To this end, appropriate covariant methods for decomposing tensors were developed. (2) Unusual properties of solutions of coupled scalar-metric fields were found. (3) a consistent linear Lorentz invariant alternate to general relativity, with self coupling replaced by a non-local projection of the conserved part of the matter stress tensor; testable experimental consequences (so far) as in Einstein theory. TAB

N70-37770# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
IDENTIFICATION OF THE 1 La AND 1 Lb VIBRONIC TRANSITIONS IN THE ABSORPTION SPECTRA OF INDOLE AND 3-METHYLINDOLE
E. Hardin Strickland, Joseph Horwitz, and Carolyn Billups May 1970 28 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-773) Avail: CFSTI

Many of the vibronic transitions of indole and 3-methylindole were identified by using solvent perturbation to differentially shift the 1La and 1Lb electronic transitions. The positions of the 0-0 1La transition were identified in the spectra of both indole and 3-methylindole. In the case of 3-methylindole dissolved in perfluorinated hexane, the 0-0 1La band (285.2 nm) is well resolved from the 1Lb transitions (0-0 at 288 nm). The remaining 1La bands of 3-methylindole cannot be identified conclusively due to overlapping 1Lb transitions. The spectra do limit the possible positions of the remaining 1La bands. In indole spectra, 1La bands can be identified at 0-0, 0 + 1700, and 0 + 2450 cm-1; other 1La bands may possibly occur at 0 + 750 and 0 + 1000 cm-1. 1Lb bands of both indole and 3-methylindole are evident at 0-0, 0 + 730, 0 + 980, and 0 − 760 cm-1. Additional 1Lb bands at shorter wavelengths are unresolved. The results of this analysis are used to more completely interpret high resolution indole spectra. In addition, the information aids in understanding the circular dichroism and absorption spectra of tryptophan in polar solvents. NSA

N70-37855# Duke Univ., Durham, N.C. Dept. of Physics.
A GENERALIZATION OF THE CONCEPT OF BOSON: THE SYMPLECTON
L. C. Biedenharn and James D. Louck (Los Alamos Scientific Lab., Albuquerque, N.Mex.) 1970 28 p refs Sponsored in part by AROD, NSF, and AEC
(AD-706833) Avail: CFSTI CSCL 20/8

The paper demonstrates by explicit construction a primitive minimal realization of the SU(2) approximately equal to Sp(2) symmetry group in terms of a single boson operator. Our construction denies the usual boson rule, and as such constitutes a true generalization of the concept of boson. The resulting inherently conjugation symmetric structure is denoted as a symplecton. Author (TAB)

N70-37867# Kentucky Univ., Lexington. Dept. of Chemistry.
INFRARED STUDIES OF CHEMISORBED MOLECULES Final Report
Hartley C. Eckstrom 12 Aug. 1969 14 p refs
(Contract AT(40-1)-2948)
(ORO-2948-100) Avail: CFSTI

Research on spectral studies of chemisorbed molecules, vibrational analysis, and sigmatropic reactions are briefly reported. The following topics are mentioned: ATR study of CO chemisorbed on Si and Ge; UV reflection experiments with ethylene chemisorbed on rhodium; vibrational analysis of cyclopentadiene; sigmatropic reactions in substituted allyl pyrroles and pyrrolenines; and IR reflectance spectra of CO and O2 adsorbed on oriented rhodium and nickel films. N.E.N.

N70-37914 Rice Univ., Houston, Tex.
A QUANTUM THEORY OF THE COHERENCE AND POLARIZATION OF LIGHT
Keh Pann (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-19324

The fluctuations of a radiation field are studied from both classical and quantum points of view and comparisons are made. Those physical phenomena in which one photon only is absorbed can be described completely by a properly chosen single-photon density matrix. As an illustration, the correlation function for black-body radiation is computed explicitly. The problem of the angular momentum carried by a plane wave is then investigated. It is concluded that the longitudinal components of the field vectors, which inevitably are present in a beam of light of finite cross section, contribute to the longitudinal components of the angular momentum; thus the usual statement that the angular momentum is carried on the surface of the beam is explained. Further, it is found that the angular momentum actually carried by a beam of light is the spin part of its total angular momentum. Using the principle, we can determine rigorously the selection rules in the optical resonance absorption experiments. Dissert. Abstr.

N70-37951# Atomic Energy Commission, Ankara (Turkey).
DATA ON RESEARCH IN NUCLEAR FUSION REACTIONS
L. A. Artsimovich and Besim Tanyel 1969 28 p In TURKISH
(NP-17949) Avail: AEC Depository Libraries

The basics of fusion reactions are briefly described and the research state of the art at midyear, 1969, is summarized. Author (NSA)

N70-37972# Oak Ridge National Lab., Tenn.
TIME-DEPENDENT NEUTRON AND SECONDARY GAMMA-RAY TRANSPORT IN INFINITE AIR AND IN AIR OVER GROUND
E. A. Straker 7 May 1970 42 p refs Sponsored by AEC
(AD-706693; ORNL-TM-2781) Avail: CFSTI CSCL 20/8

The general description of the radiation field was determined for several neutron source energies in infinite air and in an air-over-ground geometry for source heights of 50 and 1125 feet. The effect on dose of source height and detector height and the effect of the ground on energy, angular, and time dependence is discussed for both fission and 12.2- to 15-MeV neutron sources. The satisfactory agreement of calculations with experimental results from operations BREN and HENRE and the agreement between Monte Carlo and discrete ordinates results lend confidence to the cross sections used and the computational techniques. Author (TAB)

N70-37998 Arizona Univ., Tucson.
MEASUREMENT OF THERMAL NEUTRON DECAY PARAMETERS IN WATER USING A SINUSOIDAL SOURCE OF FAST NEUTRONS
John Edward Foley (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-18406

Diffusion theory predicts that the amplitude of the thermal neutron flux should decrease with frequency. There should also be a phase lag between the thermal flux and the fast source that increases with an increase in frequency. Experiments were performed by irradiating cubical light water assemblies with a sinusoidally modulated flux of fast neutrons from a 2.0-Mev Van de Graaff accelerator. A fast neutron detector was used to monitor the neutron source and a BF3-filled detector was used to record the thermal flux. The amplitude and phase lag of the thermal neutron flux were measured at several frequencies and the results were standardized using the data from the fast neutron detector. Up to three spatial modes were observed in the water assemblies with the detector in the center of the assemblies. The decay constants and amplitudes of the modes determined using this technique agree well with those determined in pulsed experiments. Dissert. Abstr.

N70-38030# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
SINGLE PHOTOPRODUCTION OF NEUTRAL PI MESONS

OF HYDROGEN IN THE EXTREME FORWARD DIRECTION AT 4 AND 5.8 GeV

M. Braunschweig (Bonn Univ.), W. Braunschweig (Bonn Univ.), D. Husmann (Bonn Univ.), K. Luebelsmeyer (Bonn Univ.), D. Schmitz (Bonn Univ.) Jan. 1970 35 p refs

(DESY-70/1) Avail: CFSTI

The differential cross section of the reaction gamma + proton yields proton + neutral pion was measured at the Deutsches Elektronen-Synchrotron DESY, Hamburg, at mean photon energies of 4.0 and 5.6 GeV for pion center of mass angles between 0 deg and 5 deg in steps of 1 deg. The production near 0 deg is dominated by the Primakoff effect. Author (NSA)

N70-38031# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

SCATTERING THEORY FOR STRONG AND ELECTROMAGNETIC INTERACTIONS OF RELATIVISTIC TWO-PARTICLE SYSTEMS

G. Schierholz (Hamburg Univ.) Mar. 1970 18 p refs

(DESY-70/12) Avail: CFSTI

Relativistic two-particle scattering is generalized to include electromagnetic interactions. A Hamiltonian consistent with the commutation relations of the inhomogeneous Lorentz group and the principle of minimal electromagnetic coupling is derived and can be defined selfadjoint. The scattering operator is computed and found to admit a representation suitable for calculations due to the invariance property of the Moller operators. Finally, the photodisintegration of bound states is discussed briefly. Author (NSA)

N70-38041# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.

ISOTOPIC ANALYSIS OF N 15 LABELLED NITRATES

M. Chemla Oct. 1968 5 p refs Transl. into ENGLISH from Bull. Soc. Chim. France (Paris), no. 4, 1968 p 1314 1315

(NP-tr-1879) Avail: AEC Depository Libraries

A measurement of the isotopic ratio N-14/N-15 for mineral nitrates was carried out by mass spectral analysis of the nitric oxide obtained by reducing nitrates in a sulfuric acid medium. This simple procedure avoids the risks of contamination caused by atmospheric nitrogen. The minimum quantity of nitrates necessary for a measurement is on the order of 0.1 micromole; the ratio N-14/N-15 can be determined with an accuracy of 0.5%. The conditions for applying this method are discussed in detail. Author (NSA)

N70-38042# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Protection Sanitaire.

EFFECTIVE PERIOD OF Be 7 IN VIEW OF THE BIOLOGICAL DOSIMETRY OF PROTONS OF HIGH ENERGY [PERIODE EFFECTIVE DU BERYLLIUM 7 EN VUE DE LA DOSIMETRIE BIOLOGIQUE DES PROTONS DE HAUTE ENERGIE]

G. Legeay, Ph. Tardy-Joubert, J. L. Guenet, and J. C. Jaureguy [1970] 6 p refs In FRENCH Presented at 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif., 5-7 Nov. 1969

(CEA-CONF-1445) Avail: AEC Depository Libraries

Experimental results show that the elimination of Be-7 formed by spallation in the intra-and extracellular spaces is more rapid than that f of doses injected in the rat at rates near to the maximum permissible quantity, fixed at 600 microcurie for the whole organism in the standard man. It is necessary to multiply the effective period found in this last case by 0.7 in order to obtain the former. If this fact is related to man in the case of a proton irradiation where the quantity of Be-7 formed would be very low, the effective period to be applied would be 30 days instead of 41 days, the value indicated by the ICRP. This correction is important for the determination of the initial activity because the measurement on the individual does not always occur immediately. This would permit a more precise determination of the dose absorbed by the organism. Author (NSA)

N70-38052# Naval Research Lab., Washington, D.C. Nuclear Physics Div.

RADIATIVE CORRECTIONS TO ELECTRON SCATTERING FROM COMPLEX NUCLEI

H. Uberall 1 May 1970 83 p refs

(AD-708717; NRL-7080) Avail: CFSTI CSCL 20/8

The report gives a review of the present status of radiative corrections to electron scattering from complex nuclei, both from the theoretical standpoint and with a view to practical applications. The first section presents a description of the general features of radiative corrections. The following four sections discuss the individual processes entering into radiative and line shape corrections and their synthesis, while the rest of the report is concerned with individual processes contributing to the radiation tail, and their synthesis (or unfolding procedure). Author (TAB)

N70-38058# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

PHOTOPRODUCTION OF POSITRON ELECTRON, RHO MESON-OMEGA MESON MIXING, AND VECTOR DOMINANCE

H. R. Quinn and T. F. Walsh Mar. 1970 19 p refs

(DESY-70/13) Avail: AEC Depository Libraries

The rho-omega mixing is discussed, in particular with respect to its possible effect on the invariant-mass spectrum of electron-positron pairs photoproduced off a nuclear target. It is found that the order of magnitude of the mixing indicated by recent experiments would yield a significant effect on the poistron electron-photoproduction. The necessity for a consistent analysis of all channels in evaluating the mixing effect is emphasized. Author (NSA)

N70-38059# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

SEARCH FOR SPONTANEOUSLY FISSIONABLE ISOMERS WITH NANOSECOND LIFE TIME IN THE REACTIONS WITH HEAVY IONS

G. N. Flerov, Yu. P. Gangrskii, B. N. Markov, Nguyen Kong Khan, D. D. Pulatov et al 1970 11 p refs In RUSSIAN

(JINR-P7-5018) Avail: AEC Depository Libraries

The search for spontaneously fissionable isomers with half-lives in the range 10 to the -9th to 10th to the-7th power s was carried out among the neutron-deficient isotopes beginning from the rare-earth region to Rn nuclei. With that end in view, the targets of elements with even Z from Te to Pt were bombarded with B-11 and O-16 ions. The technique of detecting the fission fragments of the recoil nuclei, decaying in flight, was used. The results of the experiments were negative. Only upper boundaries of the cross sections and the half-lives are presented. Using the same technique, the Th-232 and U-238 targets were bombarded with B-11, C-12, and O-16 ions. The experiments proved the existence of the spontaneously fissionable isomers with T(1/2) approximately 10 to the -9th to 10 to the -8th power s. Author (NSA)

N70-38072# Stanford Univ., Calif. High Energy Physics Lab.

ELASTIC ELECTRON SCATTERING FROM C 12 AND O 16

I. Sick and J. S. McCarthy Oct. 1969 51 p refs Submitted for publication

(Contract Nonr-225(67))

(AD-707047; SU-HEPL-617) Avail: CFSTI CSCL 20/8

Electron scattering cross sections from F to the minus 1 power and 4 F to the minus 1 power are given. The data are analyzed in terms of a phenomenological charge distribution and new information concerning the tail and the center of the charge distribution are obtained. The presence of dispersion effects appears to be necessary to explain the cross sections in the first diffraction minimum. The effect of a finite potential and short range correlations on the form factor are discussed. Author

N70-38073# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
THERMALIZATION OF 14.7 MeV NEUTRONS PRODUCED BY A LOW ENERGY ACCELERATOR [THERMALISATION DE NEUTRONS DE 14.7 MeV PRODUITS PAR UN ACCELERATEUR DE FAIBLE ENERGIE]
Herve Mouraille Feb. 1970 11 p In FRENCH
(CEA-N-1117) Avail: AEC Depository Libraries

Neutron properties of water, heavy water, graphite and beryllium were compared, and different assemblies realized with these moderators were tested. The order of magntidue of the flux obtained is given. NSA

N70-38126# Toronto Univ. (Ontario). Inst. for Aerospace Research.
GAS SURFACE INTERACTIONS
In its [Inst. for Aerospace Res.] Nov. 1969 p 87 96 (See N70-38116 21-01)
Avail: CFSTI

A combined theoretical and experimental program is reported of the various processes which occur between the surface of satellite and its environment. Because immediate answers are needed for engineering applications, part of the experimental work is aimed at simulation of orbital conditions through improved molecular beam techniques, and at studies of accommodation coefficients under these conditions. Experimental results demonstrate the complexity of the underlying physical processes, and part of the experimental program is designed to study these processes in detail, for example, by the velocity analysis of reflected molecules from atomically clean surfaces. The theoretical models being constructed contain the basic physics of the interaction as a result of the appearance of this increasing complexity in the experimental results which are not explainable with first order engineering models. The objective is the calculation of such items as exchange of charge, momentum, itself. These quantities which are moments of the differential cross section of the interaction affect the drag of the satellite, its heating, and its charge buildup. Author

N70-38168*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATISTICAL THEORY OF INELASTIC NEUTRON ENERGY SPECTRA
B. J. Henderson and C. E. Wuller, Jr. 16 Sep. 1969 29 p refs
(NASA-TM-X-53913; MSFC-IN-SSL-N-68-14) Avail: CFSTI CSCL 20H

A statistical theory of inelastic neutron energy spectra for intermediate excitation energies is developed. The final state of the residual nucleus may be either discrete or in the continuum. Calculated neutron energy distributions for aluminum are presented. Author

N70-38239# Institute of Nuclear Research, Warsaw (Poland).
THE QUASIPARTICLE AND COLLECTIVE STATES OF THE Er 165 NUCLEUS. [STANY KWAZICZASTKOWE I KOLEKTYWNE JADRA Er 165]
Z. Preibisz 1969 134 p refs In POLISH; ENGLISH summary
(INR-1102) Avail: AEC Depository Libraries

The Beta(+) and gamma spectra as well as electron-gamma and gamma-gamma coincidence spectra accompanying the Tm 165 yielding Er 165 decay were investigated. The positron radiation with E(max) = 300 + - 30 keV and intensity 6.5 + - 0.00002 positrons per decay were found. Nine new energetic levels were introduced and a decay scheme proposed. Three new rotational levels were established with band heads 1/2+, 507 keV, 1/2+, 745 keV and 1/2-, 920 keV. The character of the highest excited level in Er 165 with energy 1427 keV observed after the capture of an electron by the Tm 165 nucleus was discussed. This state is fed by the allowed unhindered beta decay au, log ft = 5.0. A suggestion is made that this excitation has a three-particle character and is due to the break of one neutron pair close to the Fermi surface. The properties of other nonrotational levels were considered in the frame work of a nuclear model which takes into account the interaction of quasiparticles states were compared with energies calculated on the basis of the Nilsson plus pairing model. Author (NSA)

N70-38282# State Univ. of New York, Stony Brook. Dept. of Physics.
AXIOMATIC QUANTUM FIELD THEORY AND SCATTERING OF ELEMENTARY PARTICLES Final Report
John S. Toll 31 Mar. 1970 16 p
(Grant AF-AFOSR-1096-66)
(AD-706929; AFOSR-70-1229TR) Avail: CFSTI CSCL 20/10

The document is the final report on a research project at the State University of New York at Stony Brook on axiomatic quantum field theory and scattering of elementary particles. The work explored the consequences of the analyticity in quantum field theory that results from strict causality, Lorentz invariance, positivity of energy, unitarity, and other fundamental axioms of quantum field theory. The results include a general proof from the axioms that any quantum field theory with non-trivial scattering must include at some energies non-trivial production as well. A general proof was given of the superconvergence relations and related analytic properties, including the case of particles with spin. Other restrictions on high energy scattering were derived. The results are detailed in 18 published papers and reports. TAB

N70-38325# Forsvarets Forskningsanstalt, Stockholm (Sweden).
A USER'S MANUAL FOR A COMPUTER CODE CALCULATING DENSITIES AND VELOCITIES OF COMPTON ELECTRONS GENERATED BY GAMMAS
G. Engstroem Oct. 1968 14 p refs
(FOA-4-4374) Avail: AEC Depository Libraries

A Monte Carlo code is described which treats the transport of gamma radiation in spherical geometry and calculates various data for the Compton electrons generated by the photons such as production densities, average radial velocities and radial current. The quantities are differentiated in time. Author (NSA)

N70-38335# Uppsala Univ. (Sweden). Inst. of Physics.
ALPHA-GAMMA ANGULAR CORRELATION AND HYPERFINE INTERACTION IN THE DECAY OF Cf 249
F. Falk, A. Linnfors, B. Orre, and J. E. Thun Aug. 1969 40 p refs
(UUIP-651) Avail: AEC Depository Libraries

The angular correlation between the main alpha-transition (5.81 MeV) and the following 388 keV E1 gamma transition (and in one case also the 333 keV E1 transition branching from the same level) in the decay of Cf-249 to Cm-245 was studied. Thin sources were used. The recoiling daughter ions are allowed to escape into vacuum. The strong hyperfine interaction perturbing the correlation in this case was neutralized by a longitudinal decoupling field with a strength of some kilogauss. The correlation was also

studied in silver and nickel surrounding where it was found to be almost unperturbed. In an insulator a strong perturbation was found which was not influenced by the longitudinal field. The unperturbed values of A(22)-coefficients do not support the mixing ratios (L = 0, L = 2, L = 4) from the Bohr-Froeman-Mottelson theory. A computer program for calculation of the combined (static) hyperfine and external magnetic interaction is developed, and the results of some calculations are presented. Author (NSA)

N70-38363# Georgia Univ., Athens. Dept. of Physics and Astronomy.
ANTISYMMETRIZED DISTORTED WAVE THEORY OF INELASTIC NUCLEON SCATTERING
H. V. Geramb and K. A. Amos [1970] 99 p refs Submitted for publication
(Grant NSF GP-8399)
Avail: Issuing Activity

Transition amplitudes for inelastic nucleon scattering from nuclei are developed using an antisymmetrized Distorted Wave approximation. Nuclear states are specified by a microscopic model of nuclear structure. The transition operator includes central, tensor, and core polarization terms. A collective model approximation is used to define the core polarization contribution. The central force has a yukawa form while the tensor force is chosen to have a modified yukawa shape. Inelastic proton scattering to the first excited state of Y-89 is analyzed for incident energies of 18.8, 24.5 and 61.2 MeV. In addition, analysis of the inelastic scattering of 61.4 MeV protons to the 5- state of Zr-90 at 2.315 MeV excitation is reported. Good fits to the data are obtained. Large effects due to exchange matrix elements are noted. Strong variations in results are seen when the central interaction singlet and triplet strengths are varied. Author

N70-38370# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
RESONANT PRODUCTION OF VECTOR MESONS BY POLARIZED PHOTONS. SPECIAL CONSIDERATIONS ON THE RHO N DECAY MODE OF DELTA(1950) AND DELTA(2420)
Dieter Schildknecht and Barbara Schrempp (Hamburg Univ.) Feb. 1970 44 p refs
(DESY-70/8) Avail: AEC Depository Libraries

The differential cross section and the vector meson density matrix elements for resonant production of vector mesons are given in terms of partial wave helicity and multipole amplitudes. A large J approximation turns out to yield a good qualitative picture of the behavior of the differential cross section and density matrix elements. Numerical results for the differential cross section and for the rho density matrix elements are presented for the special model of magnetic excitation and decay, which is motivated from quark model and vector meson dominance model considerations. The observability of these resonance formation processes with unpolarized and polarized photons is extensively discussed by taking into account the diffractive background present in neutral rho meson production from protons. Much of the material of this work may also be used to discuss resonance effects in Compton scattering. Author (NSA)

N70-38396# Duke Univ., Durham, N.C. Dept. of Physics.
BREAKDOWN OF SCALING INVARIANCE IN THE GENERALIZED BJORKEN LIMIT OF PERTURBATION THEORY
P. L. F. Haberler, N. R. Lipshutz, and O. L. Weaver [1970] 12 p refs Sponsored in part by AROD and NSF
(AD-706834) Avail: CFSTI CSCL 20/8

The document examines the cross-sections for meson electroproduction in two model field theories. It is found that for the interaction of neutral scalar mesons with nucleons the structure functions exhibit scaling in the generalized Bjorken limit, but that for the case of the charge independent pseudoscalar meson-nucleon interaction, scaling does not always occur. The origin of this breakdown and on its significance for parton models of deeply inelastic electron-hadron scattering is discussed. Author (TAB)

N70-38397# Duke Univ., Durham, N.C. Dept. of Physics.
NUCLEAR ROTATIONAL BANDS AND SL(3, R) SYMMETRY
L. Weaver and L. C. Biedenharn [1970] 13 p refs Sponsored in part by AROD and NSF
(AD-706835) Avail: CFSTI CSCL 20/8

An expression is derived that involves no adjustable parameters for the ratios of interband E(2) transition probabilities in deformed even-even nuclei. The derivation is based on the idea, due to Gell-Mann, that the relevant operators generate the algebra of SL(3, R). Author (TAB)

N70-38398# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
PARTITIONING PERTURBATION THEORY, 4
Joseph O. Hirschfelder 10 Mar. 1970 29 p refs Prepared in cooperation with Florida Univ., Gainesville
(Grants AF-AFOSR-1886-70; NSF GP-12832)
(AD-706859; WIS-TCI-381) Avail: CFSTI CSCL 7/4

The Certain-Hirschfelder partitioning formalism is summarized. For electron exchange problems this leads to the Hirschfelder-Silbey treatment or a generalization of it. It is suggested that good values of the energy may be calculated by a simple approximation which does not involve any exchange functions. Author (TAB)

N70-38400# Duke Univ., Durham, N.C. Dept. of Physics.
SU(3) x SU(3) AND DILATATION INVARIANCE OF STRONG INTERACTIONS: HOW ARE THEY REALIZED IN THE SYMMETRY LIMIT?
P. L. F. Haberler [1970] 10 p refs Supported in part by the ARO(D) and NSF
(AD-706838) Avail: CFSTI CSCL 20/8

On general field theoretic grounds it is argued that the bare mass of the proton (baryon-octet) vanishes without implying vanishing physical masses. This suggests that SU(3) x SU(3) and dilatation invariance are realized through the Goldstone-Nambu mechanism in the symmetry limit. Author (TAB)

N70-38455# California Univ., Berkeley. Dept. of Physics.
THEORETICAL PHYSICS OF ELEMENTARY PARTICLES Final Report
Stanley Mandelstam 1970 11 p refs
(Grant AF-AFOSR-1471-68)
(AD-707564; AFOSR-70-1378TR) Avail: CFSTI CSCL 20/10

The report reviews work which has been performed in the following areas: Conspiracy theory, the Veneziano model, the Bethe-Salpeter equation, Current algebras, the Multi-peripheral equation, the Quantization of gauge fields, the Structure of local fields. TAB

N70-38498# Hamburg Univ. (West Germany).
DETERMINATION OF THE AVERAGE LIFETIME OF THE 5.105 MeV (2-) LEVELS IN N 14 WITH THE HELP OF THE RECOIL METHOD [BESTIMMUNG DER MITTLEREN LEBENSDAUER DES 5.105 MeV (2-) NIVEAUS IN N 14 MIT HILFE DER RUECKSTOSSMETHODE]
Gustav Meyer 1968 44 p refs In GERMAN Presented at the Conf. of the Profess. Comm. On Nucl. Phys., Bad Neuenahr, West Ger.

(Conf-6804161-9) Avail: AEC Depository Libraries

The adaptation of the method to the experimental conditions was necessary; this consisted principally of the development of a FORTRAN program for the evaluation of the Doppler spectrum at small recoil energies. The effect of the population of the level to be measured on higher lying levels was formally determined. The results confirm the measurements of Allen which were also made by the recoil method, but contradict the values of Bishop obtained by means of inelastic electron scattering. An unusually strong delay of the E1 transition resulted from the above results, which is forbidden in the neglect of T = 1-mixed isospin. This is valid only in the long-wave approximation. The calculation of the E1 component in the second approximation leads to a too high component in the wave function of the 5.1 Mev level. Author (NSA)

N70-38519# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

THE HILBERT SCHMIDT EXPANSION AND SOLUTION OF THE FADDEEV EQUATIONS WITH THE SQUARE-WELL POTENTIAL

V. F. Kharchenko and S. A. Storozhenko 1969 18 p refs In RUSSIAN

(ITF-69-91) Avail: AEC Depository Libraries

The motion of three identical spinless particles and the three-nucleon problem are considered in the case of pair interaction between particles characterized by the local square-well potential. The application of the separable Hilbert-Schmidt expansion allows one to reduce the problem to solving the set of single-variable integral equations. The three-particle binding energy and the scattering length of three identical spinless particles are calculated as well as the triton binding energy and the neutron-deuteron scattering lengths. The evaluation is made of the value of contribution into the binding energies and the scattering lengths of three-particle systems from the components of two-particle interaction in the states with the values of the orbital moment different from zero. Author (NSA)

N70-38520# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

REPRESENTATIONS OF THE TOTAL INHOMOGENEOUS DE SITTER GROUP AND EQUATIONS IN A FIVE-DIMENSIONAL APPROACH, PART 1

V. I. Fushchich 1970 40 p refs Presented at 3d Conf. On Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1969

(ITF-70-4 Conf-690417-25) Avail: AEC Depository Libraries

The irreducible representations of the total inhomogeneous De Sitter group P (1,4) are studied. The canonical and noncanonical equations of motion invariant with respect to the group P (1,4) are found. The equation by which it is possible to obtain the increasing mass-spectrum of particles depending on spin and isospin is suggested and, as an indirect result, the equation of motion being the covariant generalization of the Weyl-Hammer-Good equation was derived for a particle with a zero mass. It is shown that the simplest P-, T-, C-invariant equation in a five-dimensional approach is the eight-component one (6.7). The canonical transformations for the equations of the Dirac type are considered. Author (NSA)

N70-38542# Uppsala Univ. (Sweden). Inst. of Physics.

INTERNAL CONVERSION STUDIES OF TRANSITIONS POPULATING AND DEPOPULATING THE 161 keV LEVEL IN Cs 133

S. Toernkvist, L. Hasselgren, S. Stroem, J.-E. Thun, and S. Antman Aug. 1969 19 p

(UUIP-612) Avail: AEC Depository Libraries

Four transitions in Cs-133 were studied by measurements of relative conversion electron intensities and electron-gamma directional correlations. The transitions studied, 276, 223, 161 and 80 keV respectively, have in common that they feed and de-excite the 161-keV level in Cs-133. In addition the L-subshell ratios for the 81-keV transition were measured and analysed. The 161- and 223-keV transitions show penetration effects in the internal conversion process. Author (NSA)

N70-38543# Institute of Nuclear Research, Warsaw (Poland).

INVESTIGATION OF THE DECAY SCHEME OF Xe 125 AND INTERPRETATION OF THE EXPERIMENTAL RESULTS ON THE BASIS OF THE SHELL MODEL INCLUDING PAIRING AND QUADRUPOLE INTERACTIONS [BADANIA SCHEMATY ROZPADU Xe 125 I INTERPRETACJA OTRZYMANYCH WYNIKOW NA GRUNCIE MODELU POWLOKOWEGO Z UWZGLEDNIENIEM ODDZIALYWAN PAIRING I KWADRUPOLOWYCH]

J. Ludziejewski 1969 13 p refs In POLISH; ENGLISH summary

(INR-1110) Avail: AEC Depository Libraries

Study of the decay scheme of Xe-125 to I-125 was carried out using germanium and silicon detectors as well as NaI/Tl and anthracene crystals. Samples Xe-125 were prepared by irradiating natural Xe in a reactor. Some measurements were done using also mass-separated Xe-125 sources. The singles and coincidence gamma spectra, the life-time of the first three excited states, the total decay energy of Xe-125, and the gamma-gamma angular correlations were measured. Based on these measurements the decay scheme of Xe-125 was proposed, the log ft values of electron capture transitions to the excited states of I-125 were determined, and the reduced transition probabilities B M1 and B E2 as well as spins of several excited states of I-125 and Xe-125 ground state were established. The results concerning the low-energy states of I-125 obtained were compared with the prediction of the single particle model as well as with the Kisslinger-Sorensen model. Author (NSA)

N70-38544# Uppsala Univ. (Sweden). Inst. of Physics.

CONVERSION PROBABILITY OF THE 35 keV TRANSITION IN Te 125

A. Marelius, K.-G. Vaelivaara, Z. Awwad, J. Lindskog, J. Pihl, and S.-E. Haegglund Aug. 1969 5 p refs

(UUIP-652) Avail: AEC Depository Libraries

The probability for K-conversion of the 35 keV M1 + E2 transition was determined from coincidences between Auger electrons and conversion electrons. The decay of the 58 days metastable 145 keV level in Te-125 consists of two transitions in cascade, a 109 keV M4 transition to the 35 keV state followed by a 35 keV M1 + E2 transition to the ground state. Measurements of relative conversion intensities require in this case knowledge of electron detector efficiency over a wide energy range. The experimental methods make use of either X-rays of Auger electrons to derive conversion probabilities. Coincidences between Auger electrons and conversion electrons are used in the present measurement. The advantage is that, for deriving the K-conversion probability, no knowledge of detector efficiencies or fluorescent yield is required. Author (NSA)

N70-38555# Institute of Nuclear Research, Warsaw (Poland).

HYPERNUCLEI LAMBDA-N INTERACTION AND HYPERNUCLEAR SPECTROSCOPY

Jerzy Pniewski 1969 67 p refs

(INR-1151) Avail: AEC Depository Libraries

A review is given of the problems of Lambda-N interactions and hypernuclear spectroscopy. The main experimental results related to these problems are briefly summarized. Topics covered

include: experimental data on Lambda-binding energies and hypernuclear spins; field theoretic approach to the Lambda-N strong interaction; phenomenological theory of hypernuclei; Lambda-p elastic scattering; charge symmetry breaking effects in the Lambda-N interactions; hypernuclear resonances; hypernuclei isomers; short-lived gamma-transitions; and perspectives of the counter technique for hypernuclear spectroscopy. In summary it is concluded that two main problems waiting to be solved by hypernuclear spectroscopy are the real spin-dependence and the contribution of the possible noncentral components of the Lambda-N interaction. NSA

N70-38573# Mainz Univ. (West Germany). Inst. fuer Anorganische Chemie und Kernchemie.

THE DECAY OF THE 3.2-hr CADMIUM-117m AND 2.4-hr CADMIUM-117g [ZERFALL DES 3.2H CADMIUMS-117M UND 2.5H CADMIUMS-117G]

W. Kiefer and G. Herrmann 1968 8 p refs In GERMAN Presented at Profess. Comm. on Nucl. Phys., Bad Neuenahr, West Germany, 1-6 Apr. 1968 Prepared in cooperation with CERN (CONF-680461-3) Avail: AEC Depository Libraries

The decay of two isomeric isotopes of Cd-117 produced by thermal reactions with Cd-116 and by spallation of Sn with 18-GeV protons followed by electromagnetic isotope separation, was studied. In the samples produced by the (n,gamma) reaction the half lives of all gamma lines with more than 1% relative frequency were determined and the lines were assigned to the isomers. The assignments were based on the variation of the relative frequences in the samples produced by tin spallation. The decay scheme of the 2.5-hr CD-117g with spin and parity of 1/2+ is given. The decay scheme of the 3.2-hr Cd-117m is also given. NSA

N70-38594# Los Alamos Scientific Lab., N.Mex.

LAPH: A MULTIGROUP PHOTON PRODUCTION MATRIX AND SOURCE VECTOR CODE FOR ENDF/B

Donald J. Dudziak, Alan H. Marshall, and Robert E. Seamon May 1970 116 p refs

(LA-4337; ENDF-132) Avail: CFSTI

The LAPH code retrieves photon production cross sections or photon production multiplicities and corresponding neutron interaction cross sections from ENDF/B (Evaluated Nuclear Data File/B). It then applies suitable weighting functions over G specified photon groups and N specified photon groups and N specified neutron broad groups to construct a G × N photon production matrix. Pointwise cross sections are first integrated over each photon energy group with constant or direct energy weighting. Within each neutron broad group, arbitrary fine-group weighting functions are read from input. Resonance fine-group interaction cross sections and weighting functions are also read as input. Macroscopic photon production and photon energy production matrices are then computed. A sample problem is included along with an indexed listing of the code. The code is written in FORTRAN 4 for a CDC-6600 computer. Author (NSA)

N70-38596# Iowa State Univ. of Science and Technology, Ames. Dept. of Physcis.

SOME APPLICATIONS OF COHERENT STATES IN QUANTUM ELECTRODYNAMICS

Dennis Leland Nordstrom (Ph.D. Thesis) Feb. 1970 77 p refs

(Contract W-7405-eng-82)

(IS-T-340) Avail: CFSTI

An alternative treatment of the infrared divergence problem in quantum electrodynamics is described. A diffraction dissociation approximation is used to show that the spurious infrared divergence is due to the self-field of the electron and only arises from an incorrect application of the Feynman-Dyson perturbation theory. The soft-photon contributions are incorporated into the asymptotic electron states and are eventually shown to belong to a Hilbert space unitarily inequivalent to the occupation number space. The amount of the self-field that is cancelled depends on the momentum spread given the modified electron wave packet state and may be chosen to correspond with experiment. The cancellation is made and the parametrization of the coherent states is determined. The resulting coherent state is found to have the same singularity structure in its parametrizing function as obtained previously thus elminiminating the infrared divergences for any scattering process. Author (NSA)

N70-38642# Stanford Univ., Calif. High Energy Physics Lab.

X-RAY AND GAMMA-RAY STUDIES OF HIGH ENERGY ELECTRON SCATTERING EVENTS USING SEMICONDUCTOR DETECTORS

L. M. Middleman, R. L. Ford, and R. Hofstadter May 1970 53 p refs Submitted for publication Sponsored in part by NSF (Contract Nonr-225(87))

(AD-707048; SU-HEPL-618) Avail: CFSTI CSCL 7/4

Using high resolution semiconductor detectors, a study was made of the large K-ionization cross sections of atoms over a wide range of atomic numbers (Z = 29 to Z = 83) and of incident electron energies (E = 150 MeV to 900 MeV). For the higher Z elements (Z > 60) the L X-ray cross sections were also measured over the incident electron energy range. Ratios of the relative intensities of various distinct lines were determined and compared to recent low energy work. The results of the K-ionization experiment are compared to the recent relativistic calculations of H. Kolbenstvedt. A search for nuclear gamma-rays produced by high energy electron scattering was also undertaken in this work. No nuclear gamma-ray lines were detected. The null results were explained by recent theoretical calculations. Author (TAB)

N70-38658# Wayne State Univ., Detroit, Mich.

STUDIES OF SCATTERING DYNAMICS AND CLASSIFICATION OF ELEMENTARY PARTICLES Progress Report

[1969] 4 p refs Supported in part by NSF

Avail: Issuing Activity

The invariance properties of the nonrelativistic Coulomb problem associated with the Lie group O(4), and the isotropic harmonic oscillator associated with the Lie group SU(3) were investigated. Two possibilities of invariance Poisson bracket algebra were considered: (1) the commutator algebra has higher terms in h and does not close, hence the invariance group involves an infinite order algebra, and (2) only the expectation values (diagonal elements) of the commutator algebra agrees with the classical algebra. The properties of separability operators and invariance ladder operators were studied with respect to the nonrelativistic Coulomb problem. R.B.

N70-38662# Pittsburgh Univ., Pa. Dept. of Physics.

THE QUANTIZATION OF m SQUARE LESS THAN ZERO FIELD EQUATIONS

Bert Schroer Apr. 1970 17 p refs

(Contract AT(30-1)-3829)

(NYO-3829-49) Avail: CFSTI

The smallest causal covariant field theory in which the Wigner m to the 2nd power < 0 representations of the Poincare group can be imbedded is constructed. Jelly-states lead to a causal screening of tachyon-states. Author (NSA)

N70-38663# Brown Univ., Providence, R.I. Dept. of Physics.

FIELD THEORETIC MODEL OF HIGH ENERGY SCATTERING 3. INELASTIC ELECTRON-PROTON SCATTERING

H. M. Fried and T. K. Gaisser (Cambridge Univ.) [1969] 18 p refs Sponsored in part by AEC Prepared in cooperation with Cambridge Univ.
(NYO-2262-TA-217) Avail: CFSTI

The predictions which follow from a simplified version of the soft, virtual, neutral vector meson field theoretic model are described. It is assumed that neutral vector mesons are copiously produced in inelastic e + p channels and that they can be described by a simple generalization of the soft photon methods conserving energy and momentum exactly in all processes, while approximating the nucleon emission operators by those applicable to the case of soft mesons. The emission porbabilities are not computed directly, but are inferred by means of unitarity from the off-shell Compton amplitudes. NSA

N70-38684# Columbia Univ., Irvington, N.Y. Nevis Labs.
DALITZ PLOT ANALYSIS OF THE DECAYS OF ETA-MESON YIELDS THREE PION AND ETA-MESON YIELDS TWO PION PHOTON. THE BRANCHING RATIO ETA-MESON YIELDS TWO PION PHOTON/ETA-MESON YIELDS THREE PION
Michael Gormley (Ph.D. Thesis) 1970 97 p refs
(Contract AT(03-1)-1932)
(NEVIS-181; R-706; CU-285) Avail: CFSTI

The charge asymmetry in the decay eta-meson yields positive pion, negative pion, and photon is measured. From a sample of 7257 events, an asymmetry of 1.22 + - 1.56% The angular distribution is consistent with J = 1 for the dipion angular momentum. The measured gamma-ray energy spectrum disagrees with the prediction of the simplest gauge invariant matrix element but is well represented by a simple rho-dominant model. The Dalitz Plot distribution of 30,905 examples eta-meson yields positive pion, negative pion, and neutral pion decay was fitted to a power series expansion of the matrix element. A matrix element linear in the neutral pion kinetic energy does not fit our data. The branching ratio eta-meson yields positive pion, negative pion, and photon/eta-meson yields positive pion, negative pion, and neutral pion to be 0.201 + or - 0.006. Author (NSA)

N70-38671# International Centre for Theoretical Physics, Trieste (Italy).
LORENTZ-INVARIANT LOCALIZATION FOR ELEMENTARY SYSTEMS. PART 3: ZERO-MASS SYSTEMS
A. J. Kalnay Oct. 1969 21 p refs Submitted for publication
(IC/69/134) Avail: CFSTI

The localization problem in the relativistic quantum mechanics of zero-mass elementary systems with spin 0, 1/2 and 1 and physical consistency when seen from two different frames of reference were studied. The results are essentially the same as those obtained for systems of mass greater than zero. Author (ESRO)

N70-38679# International Centre for Theoretical Physics, Trieste (Italy).
LOW-ENERGY WEAK SINGLE-PION PRODUCTION BY CURRENT COMMUTATORS
N. Paver (Trieste Univ.), E. E. Radescu, and C. Verzegnassi (Trieste Univ.) Oct. 1969 37 p refs Submitted for publication
(IC/69/127) Avail: CFSTI

A description is given of the weak single-pion production process in the slow pion region, based on current commutators and an extensive use of PCAC. The predictions obtained completely describe the s-wave and p-wave multipoles. Author (ESRO)

N70-38880# International Centre for Theoretical Physics, Trieste (Italy).
ON THE RENORMALIZATION OF THE REGGEIZED FEYNMAN AMPLITUDES
H. Sugawara Jan. 1970 8 p refs Submitted for publication Sponsored by Sakko-Kai Found.
(IC/70/2) Avail: CFSTI

Elimination of the divergence of the Bardakci loop function by renormalizing the Reggeized Feynman amplitudes for particle mass and mixing parameter is suggested. The discussion is restricted to the scattering of scalar particles. ESRO

N70-38689 Oklahoma Univ., Norman.
A STUDY OF THEORETICAL METHODS OF CALCULATION OF EXCITATION CROSS SECTIONS OF TWO-ELECTRON SYSTEM BY ELECTRON IMPACT
Edward Tak-Ping Lee (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-17654

A calculation of the cross section of (He(-), 4 P)and (He(+), 4 D) was made. The cross section of (He(+), 4F) is estimated. Also cross sections by Ochkur's formula are obtained. A first principle calculation of the polarization potential and the vibrational excitation cross section was made. Cross sections are obtained with Born approximation and also by Close Coupling formulation. It is concluded that quantum mechanical calculation of vibrational excitation cross section of H2 by electron impact produces results that agree with experiment. Dissert. Abstr.

N70-38690 California Inst. of Tech., Pasadena.
APPLICATION OF MULTI-REGGE THEORY TO PRODUCTION PROCESSES HIGH ENERGY MODEL FOR PROTON-PROTON SCATTERING
Richard Gwin Lipes (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-19590

The case of three body final states is developed in detail, both with respect to kinematics and multi-Regge dynamics. The experimental consistency of the multi-Regge hypothesis is tested in a specific high energy reaction. In addition, the results demonstrate a severe suppression of double Pomeranchon exchange, and show the coupling of two Reggeons to an external particle to be strongly damped as the particle's mass increases. With the use of two body Regge parameters, order of magnitude estimates of the multi-Regge cross section for various reactions are given. A diffraction model for high energy proton-proton scattering is presented. The Chou-Yang model with the empirical proton form factor as input is applied to calculate a high energy, fixed momemtum transfer limit for the scattering cross section. This limiting cross section exhibits the same dip or break structure indicated in present experiments. Possible spin dependence is introduced through a weak spin-orbit type term which gives good agreement with pp polarization data. Dissert Abstr.

N70-38700# Institute of Nuclear Physics, Krakow (Poland).
STRUCTURE OF THE LOW LYING LEVELS OF THE S 33 NUCLEUS INVESTIGATED BY THE S 32 (d,p) REACNION
A. Bobrowska, K. Chyla, A. Strzalkowski, U. Tomza, and S. Wiktor Nov. 1969 17 p refs
(INP-688) Avail: AEC Depository Libraries

An investigation of the S-32(d,p)S-33 reaction was made at the deuteron bombarding energy of 12.3 MeV. The energy spectra were measured by magnetic analysis and the obtained angular distributions compared with the predictions of DWBA, using the deuteron optical model parameters obtained from the analysis of the elastic scattering of deuterons on S-32 nuclei. The absolute values of spectroscopic factors, extracted on this basis, indicate a significant contribution of higher configurations in the ground-state wave function of the S-32 nucleus. There are no arguments which permit the identification of the observed states of S-33 nucleus as rotational states. Autbor (NSA)

N70-38704 Princeton Univ., N.J.
EXCITON-MAGNON INTERACTION IN ANTIFERROMAGNETIC INSULATORS
Smith Freeman (Ph.D. Thesis) 1969 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18163

The one exciton, one magnon interacting system is treated for an antiferromagnetic insulator at T = 0. A non-zero exciton dispersion is included, and the results are applied to the magnon sideband of a particular excitonic transition in MnF2, for which the exciton has a large negative dispersion. An exciton-magnon spin Hamiltonian is first heuristically derived and justified. It is found that the source of the exciton dispersion and the exciton-magnon interaction is mainly the interatomic exchange interactions, to treat the interacting exciton-magnon system, the spin Hamiltonian is converted to a quasi-boson form by a generalization of the familiar Holstein-Primakoff method. The resulting exciton-magnon interaction Hamiltonian includes scattering terms and also terms which create or destroy a magnon pair while scattering the exciton. The approximation of neglecting these latter terms is carefully justified. The exciton-magnon scattering problem is then treated essentially without further approximation. Dissert. Abstr.

N70-38716# Scientific Translation Service, Ann Arbor, Mich.
LEVELS OF Nd 144 EXCITED DURING THERMAL NEUTRON CAPTURE [UROVNI ND 144 VOZBUZHDAEMNE PRI ZAKHVATE TEPLOVNKH NEITRONOV]
Ya. Ya. Berzin et al Apr. 1970 11 p refs Transl. into ENGLISH from a Russian Preprint Prepared for Argonne Natl. Lab., Ill.
(ANL-Trans-824) Avail: CFSTI

Measurements were made of the conversion electron spectra emitted during the thermal neutron capture by neodymium-143 in order to determine more accurately the multipole order of transitions to complete the level scheme and establish more accurately their energies. This level scheme is shown. NSA

N70-38733# International Centre for Theoretical Physics, Trieste (Italy).
CONTRIBUTION TO THE DECAY THEORY OF UNSTABLE QUANTUM SYSTEMS
L. Fonda and G. C. Ghirardi (Trieste Univ.) Jan. 1970 18 p refs Submitted for publication Sponsored in part by Ist. Nazl. di Fis. Nucl.
(IC/70/4) Avail: CFSTI

A definite physical prescription is given in order to obtain the wave function describing an unstable quantum system produced in a scattering experiment and the connections between the two standard approaches for describing unstable systems are completely clarified. A definite relation between the energy form factor of the unstable state and the T-matrix for the considered scattering process is established. The desired relation is first derived in an exact way in potential scattering and reasonable approximations are used in more general situations. Author (ESRO)

N70-38739# Los Alamos Scientific Lab., N. Mex.
TARGET-TO-DETECTOR TRANSPORT CODE FOR LOW ENERGY P-P VACUUM POLARIZATION AND BREMSSTRAHLUNG EXPERIMENTS
J. D. Johnson (State Univ. of N.Y., Stony Brook), L. E. Porter (Montana State Univ.), and J. E. Brolley Sep. 1969 147 p
(Contract W-7405-eng-36)
(LA-4274; UC-34; TID-4500) Avail: CFSTI

A particle transport computer code called DIVLENS is described in detail. The main program selects particles at random from a beam-illuminated target volume and follows them through a spherical electrostatic lens to detectors. One group of subroutines obtains the lens electrostatic potential, whereas a second group calculates the energies of inelastically scattered particles. Complete listings, flow charts, and input-output synopses are included. Author (NSA)

N70-38740# Oak Ridge National Lab., Tenn. Isotopes Div.
ISOTOPE PROGRAM (5000) Quarterly Progress Report, Period Ending 31 Mar. 1970
J. H. Gillette May 1970 18 p ref
(Contract W-7405-eng-26)
(ORNL-TM-2985) Avail: CFSTI

Research progress is reported on target fabrication and development, stable isotope separations, radioisotope separations, sector isotope separator experiments, processing chemistry, and isotope preparation and sales. NSA

N70-38741# Sandia Corp., Albuquerque, N.Mex.
AN IMPROVED CAPABILITY FOR SOLUTION OF PHOTON TRANSPORT PROBLEMS BY THE METHOD OF DISCRETE ORDINATES
James H. Renken and Kenneth G. Adams Dec. 1969 195 p refs
(SC-RR-69-739) Avail: CFSTI

A useful method for performing photon transport calculations is the method of discrete ordinates. For one-dimensional problems the formalism of this method was implemented by a computer program called DTF-4. This program was originally written at Los Alamos for the solution of neutron transport problems. A modified version of the original program was developed that is particularly convenient for the solution of photon transport problems. This new program is called DTF69. Modifications include provisions for external photon sources and the capability to treat secondary radiation such as fluorescence and positron annihilation photons. Presented here is the information necessary to use DTF69 for the solution of photon transport problems. Author (NSA)

N70-38748# Stanford Univ., Calif. Dept. of Physics.
NUCLEAR STRUCTURE INVESTIGATIONS WITH AN FN TANDEM ACCELERATOR Progress Report, 1 Mar. 1969 - 28 Feb. 1970
Stanley S. Hanna and Walter E. Meyerhof 21 Jul. 1970 150 p refs
(Grant NSF GP-8183)
Avail: Issuing Activity

Research continued on the Tandem Van de Graaff accelerator. The properties of mass 4 and 5 compound nuclei were investigated and it was shown that they could be explained in terms of broad, virtual levels. Analog states of mass 16 and 18 nuclei were studied and it appears that level shifts between analog states might provide a sensitive tool for the investigation of nuclear wave functions. The applicability of a distorted-nucleus model to the properties of Na-21 was investigated. A differentially pumped gas target was used. Studies of the giant resonance, spanning nuclei over most of the periodic table, were continued. In several heavier nuclei the split-up of the giant resonance into isospin components was found. Analog states in medium mass nuclei can be explained in terms of a generalized optical model potential. The existence of a spin-spin term in the optical model potential has been experimentally found by studying the scattering of polarized neutrons on polarized Co-59 nuclei. Nuclear structure investigations of several nuclei were made by the use of special reactions. Author

N70-38753 Boston Univ. Mass. Graduate School.
SUM RULES IN HIGH ENERGY ELECTRON-PROTON SCATTERING
Urbano Oseguera-Valladares (Ph.D. Thesis) 1969 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No.

69-18437

The nonrelativistic quark model is used in the framework of ordinary quantum mechanics to obtain an explicit form of the baryon current operator, by starting from the matrix element for elastic scattering. Inelastic scattering of electrons by protons is determined by a tensor which depends on two inelastic form factors. The tensor can also be used to determine the photoproduction cross section, and a relation can be obtained between the form factor and the photoproduction cross section. Since tensor depends on the baryon current, the inelastic form factor is separated from the tensor to obtain a sum rule in terms of the baryon current. The relation of the form factor to the photoproduction cross section is used to compare the results with experiment. Dissert. Abstr.

N70-38764 Catholic Univ. of America, Washington, D.C.
CORRELATION AND ANALYSIS OF THE MASS, ENERGY AND RADIATION EMISSION CHARACTERISTICS OF FISSION FRAGMENTS RESULTING FROM THERMAL NEUTRON CAPTURE BY U 233, U 235 AND PU 239
Reginald Charles Rodgers (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-19013

Utilizing semi-empirical mass formulations and the measured prompt fission fragment mass yields, kinetic energies and neutron yields, improved models have been formulated to determine the charge and deformation energy of the fission fragments, their prompt neutron yields and the fission product yield resulting from thermal neutron capture by U-233, U-235 and Pu-239. In this treatment, two appropriately weighted charge numbers are determined for each fragment, each fragment pair is analysed separately and the total neutrons yield and energy spectrum are determined by suitably averaging the results for each fragment pair. The initial fission product mass yield curve compared favorably with mass spectrometer and radio-chemical results. The yields of some experimentally identified, delayed neutron precursors are estimated. This analysis predicts 2.44, 2.42, and 3.09 prompt neutrons per fission from U-233, U-235 and Pu-239, and a total prompt gamma energy per fission of 7.76, 7.65 and 6.71 MeV, respectively; these results are in good agreement with measured values. Dissert. Abstr.

N70-38777 Washington Univ., Seattle.
COUPLED SAMPLING WITH THE MONTE CARLO METHOD IN NEUTRON TRANSPORT CALCULATIONS
Leland La Velle Carter (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18278

A coupled sampling technique is developed to minimize the total computation time for a given precision in the estimate of a functional, such as a reaction rate, due to a given neutron source distribution. The estimate of the functional is obtained by the Monte Carlo probabilistic simulation through sampling from the adjoint neutron transport equation and the utilization of the energy-dependent reciprocity theorem. This approach is advantageous when the phase space volume that contributes to the functional is small since particles begin their lifetimes in the phase space volume of interest. This procedure overcomes the serious limitation encountered by sampling from the transport equation, where only a small fraction of the source neutron will pass through the small phase space volume of interest during their lifetimes. Dissert. Abstr.

N70-38780 University of Southern Calif., Los Angeles.
PROTON INDUCED CHARGED PARTICLE REACTIONS ON NITROGEN-14 AT 46 MeV
Hagop Hokhikian (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-17883

Charged particle reactions resulting from the bombardment of nitrogen gas were studied at an incident proton energy of 46 MeV. The emerging deuterons, tritons, He-3, and He-4 particles were detected by a counter telescope consisting of a 250-micron totally depleted surface barrier detector and two lithium drifted silicon detectors in parallel. Elastically scattered protons were detected by a NaI(Tl) detector. The experiment showed that at 46 MeV incident proton energy a direct reaction mechanism predominates. Several different exit channels are available at this energy and this permits extensive studies of nuclei and nuclear states not accessible to other modes of investigation. Dissert. Abstr.

N70-38783 Boston Univ., Mass. Graduate School.
ELECTRO-PROTON SCATTERING BY POTENTIALS SUGGESTED BY A NEW APPROACH TO QUANTUM ELECTRODYNAMICS
Stephen Graham Hamilton (Ph.D. Thesis) 1969 263 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 69-18796

A new approach to quantum electrodynamics is applied to electron-proton scattering, to first Born approximation, in the context of scattering by proton potentials which have forms suggested by the work of Sachs and Schwebel. The proton models are taken as charge distributions which incorporate the kinematical effects of three-momentum transfer but neglect the dynamical effect of the e-p interaction on the proton. Dissert. Abstr.

N70-38800 California Univ., Los Angeles.
INTEGRAL METHODS FOR TWO-DIMENSIONAL NEUTRON TRANSPORT IN SLAB GEOMETRY
Lawrence Barry Gratt (Ph.D. Thesis) 1969 242 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 69-17559

The two-dimensional transport problem of a point source of monoenergetic neutrons on the surface of a slab is investigated using integral transform techniques. Approximate solutions of the slab flux are developed based on the existing exact half-space solution using the integral formulation of neutron transport theory. Three methods of approximation are considered. The first uses a double Fourier transform of the iteration equation, which is solvable by the Wiener-Hopf technique. The second method omits the final transform, complicating the algebra and increasing the number of integrations within the solution. The final method is a constructed solution where semi-infinite results are used to construct the solution of a finite problem. Comparison of these methods indicates that the first one is the most suitable for numerical work. Dissert. Abstr.

N70-38801 Michigan Univ., Ann Arbor.
HANLE EFFECT IN 2 1P HELIUM
Edward Strauss Fry (Ph.D. Thesis) 1969 37 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1006

The oscillator strength for the resonance (1 1P to 2 1P) transition in atomic helium was determined from a measurement of the lifetime of the 2 1P state. This lifetime was obtained using a modified zero field leve level crossing method. The scattering sample was a thermal velocity beam of 2 1S metastable atoms. Resonant 2 micron (2 1p to 2 1P) radiation is absorbed by the 2 1S atoms, which are excited to the 2 1P state. This state then decays primarily to the ground 1 1S state with the emission of resonance (584 A) radiation. The lifetime of the 2 1P state was determined from measurements of the magnetic field dependence of the 584 A intensity. This new technique eliminates the problem of constructing a vacuum ultraviolet resonance lamp. The measured lifetime for the 2 1P state is .569 + or - .023

nsec. The resulting absorption oscillator strength for the resonance transition is 0.270 + or - 0.011. This oscillator strength agrees with the theoretical value. Dissert. Abstr.

N70-38802 Boston Univ., Mass. Graduate School.
COINCIDENCE MOESSBAUER EFFECT
Dennis W. Hamill (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-18770

The incorporation of coincidence methods into standard Mossbauer techniques and the application of the delayed coicidence Mossbauer effect to the study of certain solid state phenomena are investigated. This technique involves the accumulation of a Mossbauer spectrum which reflects the environment of the decaying nuclei during some preset time interval following the formation of the Mossbauer state. Changing the preset time permits display of the time evolution of the nuclear environment. The theoretical analysis involves a numerical integration of the exact expression for time dependent Mossbauer absorption over the experimental window in time and is shown to be successful in matching experimental data for single and multi-lined spectra. In systems where no time dependent solid state effects are present, the expected line narrowing at long delay times is demonstrated experimentally and theoretically, and the effect is applied to enhance energy resolution in absorber experiments. Dissert. Abstr.

N70-38804# Columbia Univ., Irvington, Nevis Labs.
A NEW MEASUREMENT OF THE LEPTONIC CHARGE ASYMMETRY IN K SUB e- DECAY
Jay Marx (Ph.D. Thesis) 1970 129 p refs
(Contract AT(30-1)-1932)
(NEVIS-179; CU-283; R-704) Avail: CFSTI

A new measurement of the leptonic charge asymmetry in K sub e3 decay has been performed at the Brookhaven AGS. The experiment yields a value of (3.41 + or - 0.37) × .001 for the assymetry with the decay into positrons favored over the decay into electrons. The effects of accidentals and of the interactions of the K sub L secondaries in the matter which makes up the detection apparatus account for the nonnegiligible corrections applied to the raw measured assymmetry. The quoted uncertainty results from both statistical and systematic errors. A discussion of the effects of this measurement on both CP phenomenology and muon universality is presented. Author (NSA)

N70-38807# Syracuse Univ., N.Y. Dept. of Physics.
CONDITIONS FOR REGGE BEHAVIOR OF AN ABSOLUTELY CONVERGENT VENEZIANO SERIES
P. H. Frampton (Chicago Univ.) and C. W. Gardiner Mar. 1970 29 p refs Sponsored by AEC
(SU-1206-221; NYO-3399-221) Avail: CFSTI

The conditions for the validity of a Regge asymptotic expansion of a scattering amplitude, A(s,t), is investigated which can be written in the form of an absolutely convergent series; a real linear Regge trajectory, and T is similarly defined. A corresponding necessary condition allows singularities in the closed interval 1/4 less than or equal to Z less than infinity. Finally, it is shown that the sufficient condition for Regge behavior of fixed t is sufficient to guarantee that A(s,t) is a meromorphic function, the residues of whose poles are obtained by summing the residues of corresponding pole in each term of the series. Author (NSA)

N70-38812# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF Np (pp) TRIPLE SCATTERING PARAMETERS R TO THE t POWER (R) AND R' TO THE t POWER (R') 510 TO 670 MeV
Kwok-Chu Leung (Ph.D. Thesis) 23 Mar. 1970 55 p refs
(Contract W-7405-eng-48)
(UCRL-19705) Avail: CFSTI

Wolfenstein triple scattering parameters R and R prime for the proton-proton system and R to the t and R prime to the t for the neutron-proton system were measured. The p-p data were measured at three angles at 510,600, and 670 MeV, and the n-p data were measured at four angles at 510 and 600 MeV. No strong energy dependence is observed in either case. A spark chamber spectrometer system was used to analyze the second and third scattering. Polarized proton and neutron beams were produced by scattering the primary proton beam off liquid hydrogen and liquid deuteron targets respectively. Good agreement is found between the proton-proton data and the published data at 430 and 660 MeV. Phase shift predictions are compared to the results. Author (NSA)

N70-38820# International Centre for Theoretical Physics, Trieste (Italy).
CURRENT COMMUTATORS, DISPERSION RELATIONS AND K sub l3 FORM FACTORS
E. E. Radescu Nov. 1969 27 p refs Submitted for publication
(IC/69/141) Avail: CFSTI

A treatment of K sub l3 decays based on current commutators and using a covariant sum rule formulation is presented. Working in a general kinematical configuration and diapersing on a line (in the plane of the squared pion mass and of the momentum transfer) which belongs to a family of curves all parallel to the steepest (kaon rest frame) parabola, definite expressions for the form factors f(+), f(-) were obtained. The relationship between these procedures and those recently reported is discussed. Author (ESRO)

N70-38821# International Centre for Theoretical Physics, Trieste (Italy).
THE RHO MESON IN LOW-ENERGY PION-NUCLEON SCATTERING
J. C. Huang and J. R. Urani (Missouri Univ., Kansas City) Nov. 1969 20 p refs Submitted for publication Sponsored in part by Univ. of Missouri Res. Council
(IC/69/138) Avail: CFSTI

Low-energy pion-nucleon scattering was studied by including the rho meson contribution to the axial-vector amplitude. By using a different treatment for the rho contribution and the q2 extrapolation, the results for the a(-) sub (1-) scattering length and b(-) sub (0+) effective range were improved while the results for the a(-) sub (0+) and a(-) sub (1+) scattering lengths were preserved. An explanation is also given of why there is no double counting of the rho meson contributions in pion-nucleon interactions when considering current algebra and rho exchange models. Author (ESRO)

N70-38834# Scientific Translation Service, Ann Arbor, Mich.
LEVELS OF Nd 146 EXCITED IN THE (n,GAMMA) REACTION [UROVNI ND 146 VOZBUZHDAEMNE V (N,GAMMA) REAKTSNI]
Ya. Ya. Berzin et al Apr. 1970 7 p refs Transl. into ENGLISH from Russian Preprint Prepared for Argonne Natl. Lab., Ill.
(ANL-Trans-823; STS-8693) Avail: CFSTI

The spectrum of conversion electrons emitted during the capture of thermal neutrons by neodymium-145 is investigated in order to refine and supplement the level scheme of neodymium-146. The spectrum of conversion electrons and gamma rays from these reactions is shown. NSA

N70-38836# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
ATOMS AND MOLECULES IN STRONG ELECTROMAGNETIC FIELDS OF OPTICAL FREQUENCY

1969 53 p refs Partly in ENGLISH and partly in RUSSIAN Reports on 9th Intern. Conf. on the Ionized Gas Phenomena, Bucharest, 31 Aug.–6 Sep. 1969
(NP-18082) Avail: AEC Depository Libraries

Field intensity effects on ionization probability were investigated for different atoms in strong electromagnetic fields and it was found that the number of quanta absorbed by electrons determines the ionization process. A Green function was used to calculate multiphase multiphoton atomic processes. Photon lux ionization of hydrogen molecules and multiphoton dissociation and ionization of water, carbon, doxide, and nitrogen molecules under strong neodymium laser field action was also studied. G.G.

N70-38842# California Univ., Berkeley. Lawrence Radiation Lab.
THE K(-) NEUTRON ELASTIC SCATTERING FROM K(-) d YIELDS K(-) d AND K(-) d YIELDS K(-) p n AT 1 GeV/c
Nathan Nay Shew Jew Apr. 1970 7 p ref
(Contract W-7405-eng-48)
(UCRL-19359-Add) Avail: CFSTI

An extension of a previous analysis of K(−) + N elastic scattering from K(−) + d yields K(−) + d and K(−) + d yields K(−) + p + n at 1 GeV/c. It is noted that as in the previous analysis the fits at 910 MeV/c are generally bad, but those at other momenta are generally better. NSA

N70-38901 Nebraska Univ., Lincoln.
AUTO-IONIZING ELECTRONS FROM ARGON WITH ENERGIES 150-210 eV AS PRODUCED BY H(+) AND H2(+)
Donald James Volz (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-17357

Electrons in the range 150 to 210 eV as produced by 125 to 300 keV H(+) and 300 keV H2(+) impacts on argon are energy-analyzed by a parallel-plate Analyzer and detected with a 14-stage electron multiplier. The experimental arrangement is such that the count rate of the electrons detected at various angles can be plotted as a function of the electron energy on an X-Y recorder. The auto-ionizing transitions appear as sharp peaks superimposed on a continuous background. The branching ratios, natural widths, and absolute energies of the levels are determined. The angular dependence of the auto-ionizing electrons is examined and found to be nearly isotropic. Dissert. Abstr.

N70-38912 Michigan Univ., Ann Arbor.
ENERGY-DEPENDENT DIFFUSION THEORY TREATMENT OF NEUTRON WAVE PROPAGATION IN A FINITE MEDIUM
Kojiro Nishina (Ph.D. Thesis) 1969 18 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18071

Investigated are neutron wave experiments in finite media such as an infinite slab and a finite cylinder of crystalline moderators. In the slab problem a monodirectional source of monoenergetic neutrons impinging normally upon one of the surfaces of the slab is considereed. In the cylindrical case, a narrow collimated beam with a Maxwellian energy distribution is incident normally upon the center of the base of the graphite cylinder. The latter problem is used to interpret the above interference experiment. Dissert. Abstr.

N70-38931# International Centre for Theoretical Physics, Trieste (Italy).
NON-LINEAR REALIZATIONS. PART 3: SPACE-TIME SYMMETRIES
C. J. Isham, Abdus Salam, and J. Strathdee Jan. 1970 34 p refs Submitted for publication
(IC/70/5) Avail: CFSTI

The study of conformal group symmetries within the framework of non-linear realizations is extended and re-expressed in terms of metric tensors and connections on space-time. The standard Vierbein formalism of general relativity is then re-interpreted in terms of non-linear realizations of the group GL(4,IR). The connection between massless Goldstone bosons and the preferred fields of non-linear realizations is emphasized. Author (ESRO)

N70-38932# International Centre for Theoretical Physics, Trieste (Italy).
NON-POLYNOMIAL LAGRANGIAN THEORIES
Abdus Salam Feb. 1970 32 p refs Presented at the Coral Gables Conf., Miami, Fla., 23–25 Jan. 1970, and the Intern. Winter School on Theoret. Phys., Schladming, Austria, Feb. 1970
(IC/70/7) Avail: CFSTI

This report deals with the problems arising from the renormalizability of nonpolynomial Lagrangians. Super graphs are used to investigate the possible infinities of nonpolynomial theories. The infinites and renormalizability are shown to depend, in a subtle manner, on the Dyson index D. The cases D = 1, 2, 3, 4, are considered individually for singularities of ghost graphs. ESRO

N70-38990# International Centre for Theoretical Physics, Trieste (Italy).
THE ACCURACY OF THE INOPIN-ERICSON THEORY OF NUCLEAR DIFFRACTION SCATTERING
A. Y. Abul-Magd and M. H. Simbel (Cairo Univ.) Dec. 1969 15 p refs Submitted for publication Sponsored in part by Ford Found.
(IC/69/143) Avail: CFSTI

The prediction of the approximate formula for the differential cross-section of the elastic scattering of strongly absorbed particles in the Inopin-Ericson theory of diffraction scattering was compared with the results of calculations using the corresponding exact formula. The agreement was good for scattering angles larger than the Coulomb deflection angle. Author (ESRO)

N70-38991# International Centre for Theoretical Physics, Trieste (Italy).
SPONTANEOUS BREAKDOWN OF CONFORMAL SYMMETRY
C. J. Isham, Abdus Salam, and J. Strathdee Jan. 1970 9 p refs Submitted for publication
(IC/70/3) Avail: CFSTI

Any Lorentz-invariant Lagrangian can be made conformally invariant provided a gauge field phi sub mu is introduced as part of a covariant derivative. The field phi sub mu, whose transformations are thus symptomatic of spontaneous symmetry breakdown, is decomposed into transverse and longitudinal pieces whose properties and possible manifestations are discussed. Among them is a natural place for C-violation. Author (ESRO)

N70-38992# International Centre for Theoretical Physics, Trieste (Italy).
REST FRAME SUM RULES FROM QUARK MODEL AND FIELD ALGEBRA
G. J. Komen and S. Pallua (Inst. Rudjer Boskovic, Zagreb) Dec. 1969 38 p refs Submitted for publication Sponsored in part by Neth. Organ. for Advan. of Pure Res.
(IC/69/147) Avail: CFSTI

The extrapolation of low-energy theorems for certain weak quantities from the soft point to the rho-mass is studied and sum rules involving the pi rho and rho N elastic scattering matrices at threshold are obtained. An important term arises from the righthand side of the equal-time commutation relation of the space components of vector currents, and the resulting sum rules are particularly suitable for discussing models which predict such commutators. In the particular case of combining the rho pi scattering

matrix sum rule with the Weinberg formula and under the simplest assumptions, both field algebra and quark model are compatible with the data within present experimental errors. Author (ESRO)

N70-38993# International Centre for Theoretical Physics, Trieste (Italy).
BROKEN CHIRAL AND CONFORMAL SYMMETRY IN AN EFFECTIVE LAGRANGIAN FORMALISM
C. J. Isham, Abdus Salam, and J. Strathdee Apr. 1970 21 p refs Submitted for publication
(IC/70/17) Avail: CFSTI

The simultaneous braking of conformal and chiral symmetry is investigated within the framework of non-linear realizations and effective Lagrangians. The explicit introduction of a massless dilaton field enables conformal invariance to be preserved in Lagrangians for massive matter fields. The Callan, Coleman and Jackiw equation remains valid notwithstanding the introduction of this particle and it is possible to construct Lagrangians which are simultaneously invariant under the chiral and conformal groups. Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-37612# Air Force Cambridge Research Labs., Bedford, Mass.
ELECTRON ENERGY DEPENDENCE OF THE MOMENTUM-TRANSFER CROSS SECTION IN XENON BY MICROWAVE INTERACTION TECHNIQUES
Denis M. Coffey Feb. 1970 112 p refs
(AD-707091; AFCRL-70-0107; AFCRL-PSRP-406) Avail: CFSTI CSCL 20/9

Microwave conductivity ratios and cyclotron resonance absorption linewidths are measured in xenon afterglow plasmas using microwave propagation and pulsed swept-frequency techniques. The momentum-transfer cross section Q(em) for electrons of energy up to 1 eV is best represented by an electron velocity (m/sec) dependence of Qem (v). The results are in general agreement with the available literature except near the Ramsauer minimum. The dissociative electron-ion recombination in xenon 300K plasmas was determined. Author (TAB)

N70-37622# California Univ., Berkeley. Dept. of Physics.
ATOMIC PHYSICS AND MANY-PARTICLE INTERACTIONS Final Report
Kenneth M. Watson 19 May 1970 7 p
(Grant AF-AFOSR-1616-68)
(AD-707562; AFOSR-70-1426TR) Avail: CFSTI CSCL 20/9

A brief summary and a publications list is presented for research which included atomic physics, plasma physics and statistical mechanics. One of the programs in atomic physics has been aimed at obtaining accurately calculated energy levels for some excited states of Helium. The other program in atomic physics has as its objective the calculation of electronic excitation and charge transfer in ion-atom and atom-atom collisions. In plasma physics a continuing study is being conducted of unstable waves in inhomogeneous plasmas. Author (TAB)

N70-37630# Avco-Everett Research Lab., Everett, Mass.
RESEARCH ON ELECTRON RICH PLASMA STABILITY Final Scientific Report, 1 Apr. 1969 - 31 Mar. 1970
G. S. Janes Apr. 1970 26 p refs
(Contract F44620-69-C-0095)
(AD-706401; AFOSR-70-1404TR) Avail: CFSTI CSCL 20/9

Theoretical and experimental studies were conducted on the production and containment of electron rich plasma in toroidal geometries. Particular emphasis is placed on wave and instability phenomena occurring in this type of plasmas. The experiments demonstrate the existence of toroidal plasma equilibria and show that stability can be ensured under properly controlled plasma conditions, in close agreement with theoretical predictions. Author (TAB)

N70-37899# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
AN EXPERIMENTAL INVESTIGATION OF THE MICROWAVE RADIATION EMITTED BY A HIGH CURRENT RELATIVISTIC ELECTRON BEAM
John A. Nation and Walter L. Gardner Apr. 1970 37 p refs
(Contract N00014-67-A-0077-0002)
(AD-707086; LPS-41) Avail: CFSTI CSCL 20/9

The development of a high frequency in a relativistic electron beam, propagating through a drift space, has been studied from measurements of the microwave emission from the beam. The results show that a part of the radiation is emitted from the region close to the beam front and that the intensity of this emission grows in time as it is convected along with the beam. The growth rate is of the order of 100,000,000/sec, and depends on the macroscopic flow parameters. Experiments in different gases show that the growth rates are approximately proportional to the ionization probability of the gas. Precursor radiation is also monitored at comparable power levels to those found at the beam front. Possible explanations of the radiation are proffered and the physical importance of the emission (about 100 kw/m. length of drift tube) on beam neutralization and structure are indicated. Author (TAB)

N70-37941# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
PINCH OSCILLATIONS IN ELECTRON-HOLE PLASMAS
Wen S. Chen and Betsy Anker-Johnson Apr. 1970 78 p refs
(AD-706953; D1-82-0965) Avail: CFSTI CSCL 20/12

It is a well known fact that a strong current can produce pinching of nonequilibrium electron-hole plasmas in InSb; previous reports include a few observations of oscillations in the voltage. The report is a systematic treatment of both theory and observation of pinch oscillations in electron-hole plasmas. Part I contains the magnetothermal pinch theory, briefly proposed in 1964 by Drummond and Ancker-Johnson and here extended so that quantitative comparison with measurements can be made. The experimental measurements are presented and the results discussed in Part II. Author (TAB)

N70-37955# Rocketdyne, Canoga Park, Calif.
THE EFFECT OF CHARGE TRANSPORT ON THE DISINTEGRATION OF LIQUID JETS Interim Technical Report, Jun. 1969 - May 1970
A. L. Huebner 31 May 1970 91 p refs
(Contract N00014-67-C-0474)
(AD-706790; R-8240) Avail: CFSTI CSCL 20/9

Development of the theory of electrified cylindrical liquid jets continued. The theory was extended to include a quantitative description of the sizes of drops formed from the jet, using a modification of the method used by Rayleigh for the unelectrified case. Test apparatus was constructed to examine the interaction of multiple electrified jets. A systematic examination was made of the jet instabilities, drop-size alteration, and charged-drop interactions, as functions of magnitude of the applied voltage, method of applying the voltage, jet separation, and jet liquid properties. Finally,

investigation was initiated of charge accumulation in complex, high-velocity flow systems. Current and voltage measurements were made on test sections of different materials and geometries for a range of liquid conductivity and Reynolds number. Constant cross-section flow passages, as well as test sections containing cross-section or wall-material variations, were studied. The experimental results were correlated or contrasted with the results of theoretical analyses. Author (TAB)

N70-37957# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
STUDY OF NUCLEAR SEEDED MHD PLASMAS Technical Summary Report, 1 Dec. 1968 - 30 Nov. 1969
William H. Ellis 30 Nov. 1969 216 p refs
(Contract Nonr-580(18))
(AD-707420; TSR-4) Avail: CFSTI CSCL 20/9

Mathematical models, formulated to describe the ion current and anode voltage characteristics of pulsed ionization chambers used in kinetic studies of Nuclear Generated MHD Plasmas, were experimentally verified. Equations, resulting from the theory, and relating the voltage signal pulse profiles to initial plasma densities, were used to determine plasma production and loss coefficients for a range of 3He gas pressures from 1-10 atmospheres. The results, which are presented, were found to be in good agreement with existing kinetic theories. The results of a numerical parametric study of ionization column dynamics in high pressure gases, including diffusion, recombination, inter-column mixing and their temperature and pressure dependence, are presented in graphical and tabular form for a wide range of temperatures and pressures. Author (TAB)

N70-38029# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL STUDY OF IONIZATION INSTABILITY IN LOW-TEMPERATURE MAGNETIZED PLASMA
E. P. Velikhov et al 1 May 1970 79 p refs Transl. into ENGLISH of the publ. 'Chislennoye Issledovaniye Ionizatsionnoy Neustoychivosti v Nizkotemperaturnoy Zamagnichennoy Plazme Moscow, Acad. of Sci. of the USSR, Inst. of Appl. Math., 1969 120 p
(AD-707116; FTD-HT-23-241-70) Avail: CFSTI CSCL 20/9

An examination is made of the statement and numerical solution of the problem of the development of ionization instability in a low-temperature magnetized plasma. Basic attention is devoted to the dynamics of the development of instability and a qualitative analysis of the phenomenon. The effectiveness of the physical model used as the basis of the examination is shown. As a result of the numerical calculations, the association between the average parameters of the plasma at process stages close to turbulence is refined. TAB

N70-38118# Toronto Univ. (Ontario). Inst. for Aerospace Research.
PLASMA DYNAMICS
In its [Inst. for Aerospace Res.] Nov. 1969 p 10-13 (See N70-38118 21-01)
Avail: CFSTI

The plasma tunnel was used with its cryogenic pumps for further studies on free jet expansions from the RF electrodeless torch and the behaviour of Langmuir probes. A pump line was installed interconnecting the plasma and low density tunnels. This has provided additional flexibility in operation. A mass flow probe has been constructed to serve as a major aid in diagnosing flow fields at high energy and low density. The theoretical work on nonequilibrium boundary layer structure is nearing its completion and is providing theoretical profiles including the effects of line radiation and nonequilibrium effects in the main flow. The work on shock structure in hydrogen is described. Author

N70-38212# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
EXPERIMENTAL TECHNIQUES IN ELECTROHYDRODYNAMICS Final Technical Report, 1 Oct. 1968 - 31 Dec. 1969
Addison G. Hardee and Knox Millsaps 30 Jan. 1970 41 p refs
(Grant AF-AFOSR-1658-69)
(AD-706934; CER69-70AGH30; AFOSR-70-0731TR) Avail: CFSTI CSCL 20/9

The critical Reynolds number for Hagen-Poiseuille flow was more accurately detected by means of the electric double layer technique. Results are obtained utilizing reversible microelectrodes mounted flush with the wall of the pipe in the region of fully developed Hagen-Poiseuille flow. Previous measurements depended on electrodes beyond the ends of the pipe, so that the effect of the entrance flow region of the pipe was included -- a source of error. Use was made of the microelectrodes to detect the streaming potential fluctuations and Fourier analysis of the fluctuation waveforms was carried ou; the autocovariance function of each waveform and the Fourier transform (spectral density) of the autocovariance function were computed. A viscosimeter capable of handling small volumes of biological fluids (such as blood) was designed and construction is almost complete. The design is based on Stoke flow between two rotating coaxial, concentric cones. Author (TAB)

N70-38327# New York Univ., N.Y. Magneto-Fluid Dynamics Div.
HYPERLIPTIC MAGNETOHYDRODYNAMIC STEADY FLOW PAST A POINT SOURCE
Stanley Friedlander Mar. 1970 97 p refs
(Grant AF-AFOSR-815-67)
(AD-706106; MF-61; AFOSR-70-0527TR) Avail: CFSTI CSCL 20/9

The disturbance field generated by a point source is obtained for steady, three dimensional, isentropic, magnetohydrodynamic flow. The flow is governed by the Lindquist equations linearized about constant velocity, matter density, and magnetic field. The flow is assumed to be hyperlipic, i.e., the negative of the free stream velocity lies within the fast wave front of the time-dependent characteristic surface but outside the two cusped slow wave fronts of this surface. There are both real and complex characteristics. Author (TAB)

N70-38393# Forsvarets Forskningsanstalt, Stockholm (Sweden).
INVESTIGATIONS ON RESONANT NONLINEAR WAVE INTERACTIONS IN A PLASMA
Staffan Hoeijer and Hans Wilhelmsson Sep. 1969 93 p refs
(FOA-2-2349) Avail: AEC Depository Libraries

The possibilities of nonlinear second-order mixed-frequency resonant interaction in a homogeneous, magnetoplasma were investigated. Collision effects and ion motions were not considered. A hydromagnetic approach is used, and a general case where the two primary waves propagate in arbitrary directions was treated. Possibilities of finding accurate numerical values of the resonances by a method of successive approximations are illustrated. Author (NSA)

N70-38468*# Techtran Corp., Glen Burnie, Md.
CHEMICAL AND VIBRATIONAL RELAXATION IN SUPERSONIC CARBON DIOXIDE FLOWS [KHIMICHESKAIA I KOLEBATELNAIA RELAKSATSHA V SVERKHZVUKOVYKH POTOKAKH DVUOKISI UGLERODA]
N. I. Yushchenkova et al Washington NASA May 1970 15 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 11, Sep. 1969 p 417-424
(Contract NASw-2037)

(NASA-TT-F-12922) Avail: CFSTI CSCL 20I

Description of a numerical integration procedure for a system of equations of gas dynamics, chemical kinetics, and vibrational relaxation, used in the determination of the distribution of vibrational temperatures in supersonic carbon dioxide flows at temperatures equal to or below 3000 deg K and at pressures ranging from 10 to 40 atm. Various possible mechanisms of the vibrational relaxation on the carbon dioxide gas are discussed. Noted as essential in the relaxation of asymmetric valence vibrations of carbon dioxide molecules is a mechanism involving an energy exchange between normal and isotopic carbon dioxide molecules. Author

N70-38478# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PHYSICAL NATURE OF LUMINESCENCE PULSATIONS IN FLUXES HEATED BY ARC DISCHARGES

G. P. Petrova 1 Apr. 1970 11 p refs Transl. into ENGLISH from the Russian

(AD-706191; FTD-HT-23-177-70) Avail: CFSTI CSCL 20/9

A photographic study of the luminescence in an argon gas flow was carried out to clarify the nature and origin of the luminescence pulsations in gas flows heated by an electric dc arc discharge. Two types of arc discharge anodes were used and the dependence of the flow rate on the time, anode type, and discharge current was determined. Producing the results shown graphically. The frequency of luminescent pulsations was in the region of 15-30 khertz, and the experimentally determined flow rates were in fair agreement (20-25 percent) with theoretical results, calculated in terms of the argon flow rate and discharge power balance. The experimental results point to an acoustical nature of the luminescent pulsations observed in gaseous flows heated by arc discharges. Author (TAB)

N70-38586# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Physikinst.

DEVELOPMENT OF A PLASMATRON ION SOURCE IN SLIT GEOMETRY FOR AN ELECTROMAGNETIC MASS SEPARATOR [ENTWICKLUNG EINER PLASMATRONIONENQUELLE IN SCHLITZGEOMETRIE FUER EINEN [ELEKTROMAGNETISCHEN MASSENTRENNER]

H. Winter (Ph.D. Thesis) Apr. 1970 85 p refs In GERMAN (SGAE-PH-93/1970) Avail: CFSTI

Developed is a plasmatron ion source in slit geometry for the electromagnetic mass separator that primarily produces rare gas ions. A simple model of ion extraction from the meniscus of the plasmatron ion source is used to obtain possible ion flux heights in relation to the radiation generating angle, the ion mass, and emission slit length; assumed is an optimal extraction potential gradient between emission slit and extraction orifice of 120 kV/cm. Optimal energy distribution of extracted ions gave half life widths of 25 eV depending on ion source operation. A strict dependence of optimal results on emission slit width is observed; oscillating of ion source plasma and degree of radiative space charge compensation depended on the slit geometry. Optimal emission slit width produced an overall efficiency of 50% for argon according to the ion flux model. Application of sintered nickel oxide cathodes resulted in uninterrupted 100 hours operation at full capacity; the overall capacity of the developed plasmatron ion source was below 150 W. Transl. by G.G.

N70-38587# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.

[RESEARCH ON A LOW BETA, MAGNETICALLY CONFINED, QUIESCENT PLASMA COLUMN Annual Progress Report, Feb. 1969 Jan. 1970

Kenneth C. Rogers and Robin O. Motz Feb. 1970 25 p refs (Contract AT(30-1)-2813)

(SIT-2813-49; SIT-247) Avail: CFSTI

Research during the previous twelve months (February 1969-January 1970) is described. This work is a continuation of the studies initiated in 1964 of a low beta, magnetically confined, quiescent plasma column (Q-plasma). The work consisted of the following: (a) optical measurement of barium ion density, (b) initiation of optical measurement of electron and ion temperature, (c) design of field coils to oscillate the plasma column adiabatically, (d) partial calculation of the cross-section for collisional excitation of the barium ion from the ground state by electron impact, (e) modification of electrode structure to utilize the full power of the new plate power supply, and (f) design and construction of probe driving mechanism and on-line probe readout for computer analysis. NSA

N70-38631# Air Force Systems Command, WrightPatterson AFB, Ohio. Foreign Technology Div.

MAGNETOHYDRODYNAMICS IN MARINE ENGINEERING

L. G. Vasilev et al 20 Feb. 1970 233 p refs Transl. into ENGLISH from the Russian

(AD-706643; FTD-HT-23-237-69) Avail: CFSTI CSCL 13/10

Contents: The development and current state of magnetohydrodynamics; Magnetohydrodynamic effects; Magnetohydrodynamic meters; Electromagnetic pumps; Magnetohydrodynamic ship propulsion; and Magnetohydrodynamic power units for moving craft use. TAB

N70-38669# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Plasmadynamik.

ON THE FLOW OF COMPRESSIBLE PLASMAS IN THE SELF-INDUCED MAGNETIC FIELD OF ARC-DISCHARGES [ZUR STROEMUNG KOMPRESSIBLER PLASMEN IM EIGENFELD VON LICHTBOGENENTLADUNGEN]

Helmut Huegel (Ph.D. Thesis—Tech. Hochschule Muenchen) Apr. 1970 119 p refs In GERMAN; ENGLISH summary

(DLR-FB-70-13) Avail: CFSTI; ZLDI Munich: 31.40 DM

The flow of compressible plasmas in axisymmetric channels under the influence of electromagnetic forces and Joule heating is described within the framework of magneto-gasdynamics. For the velocity, Mach number, pressure, density and temperature, a quasi-one-dimensional analysis gave coupled first-order differential equations that were solved by numerical integration. At dc arc discharge currents of 500 to 3,000 amps the measured values of thrust and Mach numbers agreed with theory. Author (ESRO)

N70-38678# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.

RADIATIVE ENERGY TRANSPORT IN A PLASMA REACTOR [STRAHLUNGSTRANSPORT IN EINEM PLASMA-REAKTOR]

Siegfried Kelm May 1970 56 p refs In GERMAN; ENGLISH summary

(DLR-FB-70-18) Avail: CFSTI; ZLDI Munich: 15.30 DM

The basic theory for the calculation of the radiation field and radiation flux for a known temperature distribution in the plasma is described. The determination of the temperature distribution in the plasma of an uranium-plasma reactor is discussed using the energy equation in which the radiation flux and energy sources are considered. Calculations gave a temperature of 22,000 K for the centre of the reactor. The total radiative power which leaves the plasma is considerably reduced because the temperature of the black body radiation near the walls is lower than 7000 K and because reflecting walls (liquid lithium) are assumed there. The results show that the optical radiation does not destroy the inner walls. Author (ESRO)

N70-38694# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report
J. L. Shohet 15 Mar. 1970 39 p refs
(Contract AT(11-1)-1695)
(COO-1695-26; QPR-12) Avail: CFSTI

Theoretical work during this period centered on two major problems: (1) calculation of RF heating rates by analytical means and by computer simulation, and (2) a continuation of the calculations of the free-free bremstrahlung from a relativistic anisotropic plasma. The experimental work has concentrated on developoing Langmuir-probe techniques for use on the magnetic mirror device. NSA

N70-38763# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PLASMA ANALYSIS VIA A RIGID ROTATION MODEL
W. Richard Powell and Howard M. Stainer Apr. 1970 42 p refs
(Contract NOw-62-0604-c)
(AD-707347; APL-TG-1110) Avail: CFSTI CSCL 20/9

A combined experimental and theoretical study was made of a hydrogen-helium plasma produced by a conical theta-pinch gun that fires into an evacuated drift tube containing an axial magnetic field. The experimental input to the analysis includes the magnetic field on the axis, the flux ejected by the plasma, and the frequency of the radial ($m = 0$) oscillations of the puff. The background magnetic field in the drift tube and the electron temperature, determined from the ratio of the intensities of the He II (4686 A) and He I (5876 A) lines, complete the set of input parameters. The use of a previously developed rigid rotation model allows one to obtain specific density and magnetic field profiles. A correction is then derived that enables both the fraction of the total azimuthal current carried by the ions and the ion temperature to be determined. The entire process was incorporated in a computer program that permits rapid processing of substantial amounts of data. Finally, the results of analyzing 39 puffs are tabulated. Author (TAB)

N70-38806# AC Electronics-Defense Research Labs., Santa Barbara, Calif. Aerospace Operations Dept.
CALIBRATION AND USE OF SPHERICAL AND CYLINDRICAL ELECTROSTATIC PROBES FOR HYPERSONIC WAKE STUDIES
Ian P. French, Richard A. Hayami, Thomas E. Arnold, Martin Steinberg, John P. Appleton (MIT, Cambridge) et al May 1970 46 p refs
(Contract F04701-69-C-0125; ARPA Order 1341)
(AD-707140; AC-DRL-TR69-12; SAMSO-TR-70-186) Avail: CFSTI CSCL 20/9

An experimental shock tube program was undertaken in order to calibrate electrostatic probes which may be used to make point ion density measurements in continuum flowing plasmas. An empirically derived formula which relates the ion density to the measured probe current was obtained in terms of the appropriate similarity parameters. This empirical correlation was used to interpret the ion currents collected by a radial array of negatively biased spherical probes which were positioned so as to intercept the ionized wake of a hypervelocity model in a ballistics range. The integrated ion densities were found to be in good accord with the integrated electron densities which were simultaneously measured using microwave methods. The application of the electrostatic probe measuring technique to the study of negative-ion chemistry in wakes is also illustrated and briefly discussed. Author (TAB)

N70-38972 Rice Univ., Houston, Tex.
KINETIC THEORY OF THE BOUNDARY BETWEEN THE SOLAR WIND AND THE MAGNETOSPHERE
Robert Eugene La Quey (Ph.D. Thesis) 1969 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-19313

The microscopic structure of the boundary layer between two magnetized plasmas is examined in the Vlasov-Maxwell approximation with an aim toward determining the macroscopic boundary conditions that are to be associated with such a boundary. It is shown that solutions to the full system of differential equations describing the Ferraro-Rosenbluth cold plasma sheath can always be constructed exhibiting the properties 1) the electrons turn back before the ions, and 2) the sheath is overall charge neutral. Exact stationary solutions to the one-dimensional Vlasov boundary layer problem are constructed. The microscopic instability of these boundary layers is examined in the electrostatic approximation. An integral equation is derived which describes the propagation of electrostatic fluctuations in the boundary layer. Stability of the boundary layer is then determined by analysis of an approximate dispersion relation that is derived from the integral equation. Dissert. Abstr.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-37669# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
THE COMPENSATION OF GERMANIUM SINGLE CRYSTALS BY GAMMA IRRADIATION AND PREPARATION OF RADIATION COUNTER STRUCTURES Final Report, Sep. 1968 - Sep. 1969
August F. Witt, Harry C. Gatos, and King Owyang Apr. 1970 30 p ref
(Contract F33615-69-C-1031)
(AD-707166; AFFDL-TR-70-45) Avail: CFSTI CSCL 20/12

The electronic behavior of radiation defects in high purity germanium was studied in order to evaluate the role of irradiation in the mechanism of carrier compensation. A technique was developed for the growth of highly perfect, high purity germanium single crystals by the Czochralski method. P-I-N radiation detection devices were constructed as an application of the radiation compensation process. These structures yield an energy resolution of 1.6 percent for the cesium 137 spectrum which compares favorably with a 0.5 percent resolution obtained with the best detectors produced using the lithium-drift process. The compensation by radiation defects was found to be stable at room temperature. The role of material parameters in device construction and performance was considered. Author (TAB)

N70-37681# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Div.
EPITAXIAL GROWTH OF Al2O3 ON SAPPHIRE AND RUBY SUBSTRATES BY CHEMICAL VAPOR DEPOSITION
Philip Wong and Donald R. Messier Feb. 1970 17 p refs Presented at the 2d Intern. Conf. on Chem. Vapor Deposition, Los Angeles, 10-15 May 1970
(AD-707378; AMMRC-TR-70-3) Avail: CFSTI CSCL 13/8

The growth of Al2O3 on single crystal sapphire and ruby substrates via the net chemical reaction $2\ AlCl_3(g) + 3\ H_2O(g) = Al_2O_3(s) + 6\ HCl(g)$, was investigated in the temperature range

from 1400 to 1600C. Deposits that were obtained varied from polycrystalline at lower temperatures to single crystal at the higher ones. Use of a 60 deg. oriented substrate resulted in a better quality, faster growing deposit than did use of 0 deg. and 90 deg. oriented substrates. (Authors) TAB

N70-37684# Emmanuel Coll., Boston, Mass. Oriental Science Research Lab.
ON THE UNIVERSAL CRYSTALLOGRAPHIC COMPUTATION PROGRAM SYSTEM. 2: THE 5020 UNICS
Tosio Sakurai et al Mar. 1970 31 p refs Transl. into ENGLISH from Rika Gaku Kenkyusho Hokoku (Tokyo), v. 43, no. 2, 1967 p 62 - 69
(Contract F19628-68-C-0251)
(AD-707485; EMM-69-236; AFCRL-Trans-66; AFCRL-70-0131) Avail: CFSTI CSCL 20/2

A universal crystallographic computation program system has been developed for use on the HITAC 5020E electronic computer. The system contains all the numerical calculation programs required for ordinary structure analyses and is accommodated to any space group. All programs are written in the Fortran IV language and can be applied to any computer with minor modifications. These programs will be used as a foundation in future crystallographic analyses. The basic concept of the system and details of several new program elements are described. Author (TAB)

N70-37710# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
CONDUCTION PROCESSES IN FERROMAGNETIC ALLOYS Final Report, Jan. 1969 - Mar. 1970
Luc Berger Mar. 1970 51 p refs
(Grant DA-ARO(D)-31-124-G1087)
(AD-706905; AROD-6125-9-P) Avail: CFSTI CSCL 20/12

Hall effect and magnetoresistance were measured in iron (resistivity ratio 1991 and 507) and in Fe-Co with 0.25, 0.50, 0.92%Co, in fields up to 7 Tesla at 4.2K. High-field and low-field Hall angles are related to asymmetric scattering. A side-jump mechanism is proposed for the Hall effect of ferromagnets at room temperature. It is found that the center of mass of a wave-packet undergoes a discontinuous and finite sideway displacement (delta y) of approximately 10 to the 11th power meter on scattering by a central potential, in the presence of spin-orbit interaction. Magnon heat conduction was detected in 70Ni-30Fe and 81Ni-19Fe, between 1.5K and 4K, up to 6 Tesla. Magnon conductivity varies as approximately T squared, and represents about 3.5% of total conductivity at 4K. Thermal-magnon life-time is about (2 x 10 to the -10th power) sec. Author (TAB)

N70-37721# Harry Diamond Labs., Washington, D.C.
ABSORPTION AND FLUORESCENCE SPECTRA OF TRIPLY IONIZED HOLMIUM IN CALCIUM TUNGSTATE
D. E. Wortman and David Sanders Mar. 1970 42 p refs
(AD-707380; HDL-TR-1480) Avail: CFSTI CSCL 20/5

The energy levels of the quintuplet I ground term of Ho(3+) in single crystals of CaWO4 were established by absorption and fluorescence spectra measurements. The measurements were made using crystals at temperatures near 2, 20, and 85K. Most of the observed transitions can be accounted for by the electric dipole selection rules. Magnetic dipole selection rules cannot be ruled out for some of the lower energy transitions, however. Calculations were made to determine the effects of the crystalline host material on the Ho(3+) energy levels. An effective Hamiltonian of the form suggested by Karayianis was diagonalized in a basis of Russell-Saunders wave functions to obtain the calculated energy levels and wave functions for Ho(3+). Such a calculation takes into account the complete J-mixing of the states within the ground term and is equivalent to determining the effects of the spin-orbit interaction to better than second-order. In the calculation, the best agreement between the theoretical and experimental energy levels gives an rms deviation of 10/cm. Author (TAB)

N70-37775# Harry Diamond Labs., Washington, D.C.
EPR OF Yb(3+) IN SCHEELITE SINGLE CRYSTALS
Joseph P. Sattler and Joseph Nemarich Apr. 1970 25 p refs
(AD-707381; HDL-TR-1485) Avail: CFSTI CSCL 20/5

The electron paramagnetic resonance spectra of the ground state of trivalent ytterbium have been observed in eight laser host single crystals with scheelite structure of 4.2K and X-band frequencies. The crystals used were CdMoO4, CaWO4 CaMoO4, SrMO4, SrMoO4, PbWO4, PbMoO4, and BaWO4. The tetragonal spectra for Yb171, Yb173, and the evenisotopes of ytterbium were best-fit to an axial spin-Hamiltonian. The g-factors were found to have a linear dependencc on the crystal c-axis lattice constant. All ground-state wave functions were found to be Gamma(5,6). Author (TAB)

N70-37919 Carnegie-Mellon Univ., Pittsburgh, Pa.
MAGNETOSTATICALLY COUPLED FERROMAGNETIC THIN FILMS
Joseph A. Hartman (Ph.D. Thesis) 1969 264 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 69-17505

Magnetostatically coupled films have been proposed for a number of memory and logic applications. The behavior of a single (bit) or pair of films is studied in detail. The samples examined were long rectangular strips composed of two .2 micron Ni-Fe layers, sandwiching a 2 micron silver conductor and were evaporated on a cover glass substrate. To investigate these films, a special Kerr apparatus was designed and constructed to enable both the top and bottom films to be monitored simultaneously. To aid in the specification of the optical components of the apparatus, longitudinal Kerr effect computations involving the effect of aperture, multiple reflections, and angle of incidence were performed. A model based on the well known single film properties was developed to explain the unusual quasi-static hysteresis loops observed and was used as a basis for measuring the individual film properties. Dissert. Abstr.

N70-37921 Missouri Univ., Rolla.
A CRYSTALLIZATION STUDY OF A TETRASILICIC FLUORMICA GLASS
William Henry Daniels (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-19434

The transformation of a synthetic mica composition K2Mg5Si8O20F4 from amorphous to crystalline structure was studied isothermally at selected temperatures from 560 to 1150 C. Thermal changes associated with the transformation were followed by differential thermal analysis techniques. Structural changes promoted by the isothermal treatments were observed by density measurements, Debye-Scherrer X-ray diffraction techniques, electron replication microscopy, and electron scanning microscopy. Isothermal treatment at 560 C for 9 hours produces structural ordering in quenched K2Mg5Si8O20F4 glass. Fluorine exerts a significant influence on the transformation temperature; decreasing amounts of fluorine producing increasing transformation temperatures. The crystallizing phase rapidly attains a limiting particle size and morphology at temperatures in the 600 C region. Treatments of quenched K2Mg5Si8O20F4 glass at 900 C and above promotes a change from spherulitic to blocky crystal habit, accompanied by a more complete development of mica structure during growth. Dissert. Abstr.

N70-37946# Oxford Univ. (England). Dept. of Engineering Science.
WAVES IN ANISOTROPIC MEDIA Interim Report
Hans Motz 23 Apr. 1970 6 p refs
(Grant AF-EOAR-33-67)
(AD-707556; AFOSR-70-1131TR) Avail: CSCL 20/12

A short characterization of the main results obtained during the Grant period are presented. These are followed by a list of publications on work supported by the Grant. Topics covered include the following: Temperature effects in GaAs and Gunn diodes; Harmonic generation in Gunn diodes; Microwave radiation from InSb-NiSb eutectic; Thin film emitters; Pulse compression radar; Weakly linked superconductors; Plasma confinement and acceleration; Interaction of lasers with surfaces; Plasma instabilities. TAB

N70-37948# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
A MICROMORPHIC THEORY OF MIXTURES WITH APPLICATION TO ELASTIC POLYCRYSTALLINE SOLIDS
Robert J. Twiss and A. Cemal Eringen Mar. 1970 114 p refs
(Contract N-00014-67-A-0151-0004)
(AD-707459; TR-14) Avail: CFSTI CSCL 20/12

A micromorphic theory of mixtures is developed for elastic materials such as polycrystalline mixtures or granular composites to describe their continuum behavior in terms of the average moduli of the individual constituents of the mixture. The theory is intended to extend the classical theory to include physical phenomena in which the wave length of the imposed motion is comparable to the average dimension of the intrinsic discontinuities in the material, e.g., the average grain size or inter-grain distance. Author (TAB)

N70-37962# Westinghouse Research Labs., Pittsburgh, Pa.
OPTICAL PROPERTIES AND ELECTRONIC STRUCTURE OF METALS AND SEMI-METALS Final Report
Wolfgang J. Choyke and Seymour H. Vosko 20 May 1970 20 p refs
(Contract F44620-67-C-0084)
(AD-707550; AFOSR-70-1208TR) Avail: CFSTI CSCL 20/12

Normal incidence reflectivity techniques at a metal-dielectric interface have been worked out for liquid and single crystal samples in the energy range 0.5 to 10 eV. Reflectivity measurements at 10 angles of incidence, at a given wavelength and at a metal dielectric interface, with light parallel and perpendicular to the plane of incidence were performed. The optical constants (n,k) so obtained are only of fair accuracy. On the other hand, ellipsometric measurements on liquid and cubic metals, at the dielectric-metal interface, give fairly accurate values of n,k. Difficulties arise for non-cubic metals. Normal incidence (about 7 degrees) reflectance measurements and ellipsometric measurements were performed on single crystal and liquid Hg in contact with dielectric windows (MgF2 and SiO2 respectively) for the energy range 0.5 to 10.0 eV. In the energy range 0.5 to 2.0 eV the reflectivity of the solid andliquid are not at all similar. Above 2 eV the solid and liquid reflectance values are of similar magnitude. The solid has considerably more structure in the reflectance. Values of the optical constants have been obtained by means of a least square fit of the data through the use of a Drude term plus a sum of damped oscillators for the dielectric function. The data is interpreted qualitatively in terms of band structure. Author (TAB)

N70-38015# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
ON DISLOCATIONS, PLASTICITY AND MICROMORPHIC MECHANICS
William D. Claus, Jr. and A. Cemal Eringen Oct. 1969 74 p refs
(Contract N00014-67-A-0151-0004)
(AD-706362; TR-10) Avail: CFSTI CSCL 20/12

Within the framework of micromorphic mechanics a continuum theory of dislocations is formulated for solids undergoing elastic deformations. The micromotion gradients and spin degrees of freedom of the micromorphic theory together with the concept of the Burgers circuit provide the kinematic variables, strain measures and dislocation tensors fundamental to the theory. The balances of momentum, first stress moments and energy are basic to the present theory. Together with a set of constitutive equations for the stress and stress moments, the field equations are complete. Thermodynamical restrictions and the uniqueness of static and dynamic solutions are discussed. The plane wave solution of the linear theory is discussed in detail. The dispersive branch obtained in the velocity dispersion is similar to the experimental findings of others and should provide reasonable support for the theory. The micropolar initial stress-couple stress problem containing distributions of dislocations and disclinations is formulated. Relations between the present work and existing theories are discussed. Author (TAB)

N70-38025# Commissariat a l'Energies Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
APPLICATIONS IN RADIOPROTECTION OF ALPHA AND BETA SPECTROMETRY BY SEMICONDUCTORS [APPLICATION EN RADIOPROTECTION DE LA SPECTROMETRIE ALPHA ET BETA PAR SEMI-CONDUCTEURS]
Henri De Choudens and Solange Descours Mar. 1970 48 p refs In FRENCH
(CEA-N-1158) Avail: CFSTI

The possible applications of semiconductor spectrometers in radioprotection were studied. Several types of detectors were tested in alpha-ray spectrometry and the largest one was chosen. Its sensitivity is higher in spite of its low resolving power. Alpha peaks separated by at least 260 keV can be identified on an atmospheric filter. Pu can be separated on the same filter from the solid daughters of radon. The separation of the uranium peaks from those of plutonium is made possible. In beta spectrometry, the maximum energy of a beta emitter, when alone or when coupled with another one with a very different level of energy, can be determined. In a sample possessing three well-known beta emitters, the activity of each component (even when one of them has an activity of 1 per cent of the others) can be measured quantitatively. The complex spectrum has to be analyzed by a computer program. NSA

N70-38055# Ford Motor Co., Dearborn, Mich.
NONSUPERCONDUCTING ELECTRON TUNNELING Final Report
J. A. Appelbaum and J. M. Rowell 27 Apr. 1970 21 p ref Conf. held at Prouts Neck, Maine, 3-5 Sep. 1969 Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N.J.
(Grants AF-AFOSR-ISSA-69-007; NSF GP-13863)
(AD-706419; AFOSR-69-3152TR) Avail: CFSTI CSCL 20/12

A conference on Nonsuperconducting Electron Tunneling was held at Prouts Neck, Maine from September 3-5, 1969. The first topic dealt with by the conference was how well can the overall conductance versus voltage dependences be explained by single particle tunneling theory. Next, interactions of the tunneling electron with the oxide, or impurities or particles in the oxide, led to discussion of zero bias anomalies. Finally observations of interactions within the electrodes, the many body or self-energy effects, were reported and the theory of these effects received considerable discussion. The result of the conference can be summarized briefly, namely that tunneling in normal systems, for experimentalists and theorists alike, is in some trouble unless one is satisfied with a purely qualitative understanding of the field. Author (TAB)

N?0-38066# North Carolina State Univ., Raleigh.
A DISCRETE MODEL FOR THE PREDICTION OF SUBSEQUENT YIELD SURFACES IN POLYCRYSTALLINE PLASTICITY
Kerry S. Havner May 1970 45 p refs
(Contract N00014-68-A-0187; ARPA Order 1090)
(AD-706787; TR-70-2) Avail: CFSTI CSCL 20/12

A discrete model suitable for the analysis of polycrystalline aggregate response under macroscopically uniform, quasi-static loading is developed, with particular emphasis on the characteristics of subsequent yield surfaces in stress space. Internal stress and deformation states are determined from approximating, piecewise linear infinitesimal displacement fields within crystal grains, based upon broadly defined constitutive behavior which permits inclusion of cubic or hexagonal crystal anisotropy and relatively general hardening laws over crystallographic slip systems. Appropriate aggregate matrices are established as symmetric, positive-definite, and internal fields corresponding to the solution of the discrete model are proved to be unique. Author (TAB)

N70-38184# Stanford Univ., Calif. High Energy Physics Lab.
FANO FACTOR FACT AND FALLACY
H. R. Zulliger and D. W. Aitken Mar. 1970 18 p refs
Presented at 12th IEEE Scintillation and Semicond. Counter Symp., Washington, D.C.
(Contract F44620-69-C-0042)
(AD-707095; SU-HEPL-624) Avail: CFSTI CSCL 18/4

By definition, the Fano factor (F) is an intrinsic material constant which reflects the ultimate detector resolution. The paper points out the difficulties associated with Fano factor measurements; attempts to clarify the mechanisms of some apparently anomalous behavior frequently observed in solid state detectors; presents some new experimental results for F in silicon and germanium; and derives a phenomological model for the average energy expended to produce an electron-hole pair (epsilon), which is then used to predict semitheoretical values of F. TAB

N70-38208# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1970, NO. 1 Quarterly Technical Summary Report, 1 Nov. 1969 - 31 Jan. 1970
Alan L. McWhorter 6 May 1970 52 p refs
(Contract AF 19(628)-5167)
(AD-707135; ESD-TR-70-33) Avail: CFSTI CSCL 20/12

The report covers in detail the solid state research work at Lincoln Laboratory for the period 1 November 1969 through 31 January 1970. The topics covered are Solid State Device Research, Materials Research, and Physics of Solids. Author (TAB)

N70-38262# National Bureau of Standards, Washington, D.C.
COMPARISON OF CRYOSCOPIC DETERMINATIONS OF PURITY OF BENZENE BY THERMOMETRIC AND CALORIMETRIC PROCEDURES
A. R. Glasgow, Jr., G. S. Ross, A. T. Horton, D. Enagonio, H. D. Dixon et al *In its* Precision Meas. and Calibration Feb. 1970 p 127 - 152 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

A comparison was made on samples of benzene by the thermometeric method, by which a stirred sample is frozen at nearly constant rate, and by the calorimetric method, by which a frozen sample is melted in stages by the addition of accurately controlled increments of energy under adiabatic conditions. Benzene, purified by single crystal formation and of very high purity, was contaminated in known amounts by n-heptane and samples of the same level of purity determined by both procedures. Results of this comparison showed that the large divergence between the two methods that had characterized earlier comparisons is not displayed. The differences between the analyses on all three samples are roughly of the order of the statistically estimated uncertainties of the averages and less than deviations between individual experiments by one method. Comparison of the methods with absolute values of purity could not be made because of contamination of the highly purified sample of benzene with supposedly chemically adsorbed water from the borosilicate glass walls. Author

N70-38317# Dayton Univ., Ohio. Research Inst.
SITE DETERMINATION OF THE SEXTUPLET 1 MULTIPLET SPECTRAL LINES OF Gd(3+) IN SrF2 Technical Report, 1 Jan. 1967 - 1 Jul. 1969
Michael W. Ferralli and Perry P. Yaney Wright-Patterson AFB, Ohio AFML Mar. 1970 93 p refs
(Contracts AF 33(615)-3793; F33615-69-C-1172)
(AD-706131; UDRI-TR-70-14; AFML-TR-69-318) Avail: CFSTI CSCL 20/12

A concentration study of the sextuplet I spectrum of the Gd(3+) ion doped into a single crystalline SrF2 host (Gd(3+):SrF2) has resulted in the determination of those lines of the spectrum which arise from the tetragonal site. The site identification of these lines was accomplished by comparing the growth of the integrated absorption coefficients of each line as a function of dopant level to the growth patterns of the integrated absorption coefficients of the lines of similar site in the sixtuplet P spectrum of the same system. The sites of the sextuplet P spectrum in the Gd(3+):SrF2 are well known. The study of the growth patterns of the sextuplet P spectral lines also demonstrated that the lines of different sites had dissimilar growth patterns, a fact which proved essential to the site identification of the sextuplet P spectral lines. Author (TAB)

N70-38331# Research Triangle Inst., Durham, N.C.
EFFECT OF STRESS WAVES ON P-N JUNCTIONS Final Scientific Report, 1 Jan. 1967 - 31 Dec. 1969
J. J. Wortman Jan. 1970 116 p refs
(Contract F44620-67-C-0048)
(AD-706869; RTI-S-3; AFOSR-70-1225TR) Avail: CFSTI CSCL 20/12

The electrical properties of p-n junctions under the influence of a time varying mechanical stress were investigated. A cantilevered beam of the semiconductor crystal was used to produce the mechanical stress. A theoretical model for the effects are presented along with experimental data. The thermal generation rate of charge carriers in gold-doped Si was measured as a function of stress and temperature. The generation rate was observed to increase as much as 100 percent at strain levels of 0.005. A theoretical model is presented which accounts for stress induced changes in gold energy level. Several organometallic compounds were investigated to determine the influence of hydrostatic and anisotropic strains on the electrical resistance. Large pressure related changes in resistivity were observed in square planar dB complexes of iridium and platinum in which metal-metal interaction is postulated. Compounds not having adjacent metal symmetry showed significantly less piezoresistance effects. Author (TAB)

N70-38342# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
METAL-SEMICONDUCTOR CONTACTS ON Pb(1-x) Sn(x) Te
James N. Walpole, Kenneth W. Mill, Arthur R. Calawa, and Theodore C. Harman May 1970 25 p refs Submitted for publication Sponsored in part by the Air Force
(Contract N00014-67-A-0204-0010)
(AD-706309; TR-5) Avail: CFSTI CSCL 20/12

The electrical properties of evaporated metal-semiconductor (M-S) contacts on degenerate Pb(1-x)Sn(x)Te were studied in the composition range x = 0.0 to 0.5. The properties of metal contacts on n and p-PbTe using a number of different metals can be explained with the simplest M-S contact model, requiring neither surface states nor an interfacial layer. The Fermi level at the interface shows no tendency to be pinned. Consistent with this model, both ohmic contacts and rectifying barriers were obtained using different evaporated metals. For high carrier density PbTe and Pb(1-x),Sn(x)Te a predominant tunneling component in the current is observed. The LO phonon energy of Pb(1-x)Sn(x)Te were determined for compositions x = 0.0 to 0.31. The unique nature of these contacts is further confirmed by the observation of laser emission in forward bias as a result of minority carrier injection. Photovoltaic detectors have also been fabricated which have significant response extending to a wavelength of 30 microns. Author (TAB)

N70-38389# Colorado Univ., Boulder. Photoconductive Semiconductors and Devices Lab.
SYNTHESIS AND CHARACTERIZATION OF THIN FERROELECTRIC AND SEMICONDUCTING FILMS Final Technical Report, 1 Oct. 1966 - 30 Sep. 1969
Fred Chernow Apr. 1970 143 p refs
(Contract F33615-67-C-1050)
(AD-706097; AFML-TR-70-9) Avail: CFSTI CSCL 20/12

The results of a series of electrical measurements on thin TiO2 films are described herein. Such films consistently show a negative resistance effect when noble metal electrodes are placed in contact with them. The major portion of this technical report is concerned with ion implantation of single crystal cadmium sulfide. The experimental program studied the effects of group V implants. It was found that bismuth implantations type converted CdS from its natural n-type state. P-n junctions were constructed and room temperature light emission was observed in the forward biased mode. Some of the aspects of low energy ion implantation (25-50 keV) were investigated such as penetration depth and damage. Author (TAB)

N70-38581# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE THERMOLUMINESCENCE OF AMORPHIC AND CRYSTALLINE GERMANIUM DIOXIDE [ZUR THERMOLUMINESZENZ DES AMORPHEN UND KRISTALLINEN GeO2]
Horst Boehm (Ph.D. Thesis) 1969 82 p refs In GERMAN
Supported in part by Owens-Ill., Inc., Toledo
(DISS-4281) Avail: CFSTI

The described band model considers the various electron processes in germanium dioxide crystals and explains thermoluminescence as the result of erroneous thermal ordering with local disturbance of the fourth coordination for the Ge ion. Niveaus are considered electron adsorption points and fluctuation niveaus as defect electron adsorption points. Thermoluminescence develops when thermal activated defect electrons enter the valence band and recombine with electrons in adsorption points. The addition of alkali ions into the germanium dioxide glass lattice structure stabilizes temperature dependence of the electroluminescence emission. Transl. by G.G.

N70-38598# Northrop Corporate Labs., Hawthorne, Calif.
RADIATION EFFECTS IN SILICON AND GERMANIUM Final Report
O. L. Curtis, Jr., J. R. Srour, R. F. Bass, and E. G. Wikner Washington HDL Mar. 1970 65 p refs Sponsored in part by DASA
(Contract DAAG39-69-C-0039)
(AD-707080; NCL-70-13R; HDL-69-39-1) Avail: CFSTI CSCL 20/12

The results of several related studies of radiation effects in silicon and germanium are described. Studies of short-term annealing phenomena in silicon include a comparison of the effects of fusion and fission neutron irradiation on n- and p-type material, an investigation of transient recovery following pulsed electron irradiation, and an analytical treatment of the effects of metastable charge states on short-term annealing in p-type material. A model to explain observations of radiation-induced annealing in terms of trapping is presented. An investigation of various aspects of excess density studies in bulk material was performed, including the use of a Nd:Glass laser to achieve high excitation levels in silicon. A method is presented for determining capture probability temperature dependences in semiconductors. The recombination properties of Co60 gamma-irradiated n-type germanium were determined for low resistivity material and a study of dose effects was performed. Studies were made on the influence of lithium, aluminum, and oxygen on the radiation sensitivity of silicon. Author (TAB)

N70-38685 California Univ., Riverside.
PHYSICS, SOLID STATE ELECTRON ENERGY BAND CALCULATION OF alpha MnS
Judd Quenton Bartling (Ph.D. Thesis) 1969 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-19121

A band structure of a transition metal sulfide alpha MnS is calculated by the tight binding method. The potential used in the calculation was based upon the (3s2, 3p6, 3d5, 4s0) electron configuration of manganese. The 3s and 3p states of sulfur and the 3s, 3p, 3d and 4s states of manganese were used to form trial Bloch functions. All multi-center integrals are included in the calculation and several methods of calculating these integrals are discussed. The coulomb contribution to 10Dq was obtained. A method for including more than one electronic configuration is discussed. Dissert. Abstr.

N70-38687 California Univ., Berkeley.
FAR-INFRARED STUDY OF SUPERCONDUCTORS CONTAINING MAGNETIC IMPURITIES
George John Dick (Ph.D. Thesis) 1969 58 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-18909

A new far-infrared method was developed to study the energy-gap properties of a thin superconducting film containing magnetic impurities and thus capable of exhibiting gapless superconductivity. The method allows the direct determination of the real part sigma sub 1 of the conductivity of the superconductor by measuirng calorimetrically the infrared radiation absorbed by the film. The systems studied were quenched films of lead containing either Gd or Mn impurities. The experimentally observed frequency-dependence of sigma sub 1 is found to be distinctly different from that expected for non-magnetic impurities. In the case of lead films containing Gd impurities, whose spins are due to 4f electrons, the behavior of sigma sub 1 is in good qualitative agreement with the behavior predicted by Skalski et al., on the basis of the Abrikosov-Gorkov theory. In the case of lead films containing Mn impurities, whose spins are due to 3d electrons, the behavior of sigma sub 1 is affected more drastically than predicted by this theory. These results agree with conclusions obtained in previous tunneling measurements on these systems. Dissert. Abstr.

N70-38705# Bowmar Canada, Ltd., Ottawa (Ontario). Optoelectronics Div.
ROOM TEMPERATURE INJECTION LUMINESCENCE IN

II-VI SEMICONDUCTORS Final Report, 1 Nov. 1968 - 31 Oct. 1969

David I. Kennedy and Malcolm J. Russ. Wright-Patterson AFB, Ohio. NFML Apr. 1970 138 p refs

(Contract F33615-69-C-1092)

(AD-706100; AFML-TR-70-30) Avail: CFSTI CSCL 20/6

The experimental program described in this report has primarily been concerned with ivestigations of room temperature injection luminescence in ZnTe. Congruent preliminary investigations have involved the growth of ZnTe crystals with particular emphasis on the incorporation of efficient recombination centers associated with the isoelectronic oxygen center, and investigation of the photoluminescent properties of as-grown crystals and crystals subjected to post-growth annealing. Author (TAB)

N70-38715# Utah Univ., Salt Lake City. Dept. of Physics.

DIELECTRIC LOSS AND RADIATION DAMAGE IN RUTILE, APPENDIX A

O. W. Johnson, Sverre Myhra, and J. W. De Ford [1969] 21 p refs

(Contract AT(11-1)-1434)

(TID-25434; Rept-8-App-A) Avail: CFSTI

Dielectric loss spectra for nominally pure stoichiometric rutile (TiO_2) are reported. Appropriate treatment of crystals is shown to reduce D to <0.01 over this frequency range at 27 C or to produce (reversibly) loss peaks $>$ or $=$ to 1.0. This behavior is shown to result from migration of donor defects due to electric fields induced by the presence of metal electrodes. Theoretical predictions are shown to agree well with observed behavior. Preliminary radiation damage studies using dielectric loss as a monitor of damage are described. Author (NSA)

N70-38760# Eidgenossische Technische Hochschule, Zurich (Switzerland).

PHASES AND MIXED SYSTEMS OF TERNARY-5 (BINARY-3, BINARY-4, AND BINARY-5) ELEMENTS ESPECIALLY A COMPARISON OF Al AND Ga CONTAINING PHASES [PHASEN UND MISCHSYSTEME DER TERNAREN-5 (BINAREN-3, BINAREN-4, UND BINAREN-5) ELEMENTE SPEZIELL EIN VERGLEICH DER A1- UND Ga-HALTIGEN PHASEN]

Kamal Girgis (Ph.D. Thesis) 1969 73 p refs In GERMAN; ENGLISH summary

(Diss-4357) Avail: CFSTI

Binary and ternary systems of V, Nb and Ta with Al and Ga have been studied in order to compare the crystal structural properties of Al and Ga, and also to compare those of V, Nb and Ta. Two high-Ga phases have been obtained in the V-Ga binary system. The cubic phase A15 (Cr3Si-type) is the main phase present in the composition range from V3Ga to V3Ga(0.5)Al(0.5). The phases NbAl3 and NbGa3 form together a continuous solid solution, which shows the possibility of replacing Ga by Al and vice versa. Pairs of compounds VAl3 and NbAl3; VAl3 and TaAl3; NbAl3 and TaAl3 also form continuous solid solutions. The body centered cubic phase (A2-, W-type) is more stable than the primitive phase (A15-, Cr3Si-type) in the system V3Al (A2-type) - Nb3Al (A15-type). A wide range of solid solubility has been observed in the systems V3Al-V3Sb and V3Al-V3Sn. The solid solution has the Cr3Si structure. It was also found, that the superconducting transition temperature is raised when Sb and Sn are replaced by Al in V3(Sb,Al) and V3(Sn,Al). Author

N70-38815# Idaho Univ., Moscow. Dept. of Physics.

COLOR CENTERS AND THE REFRACTIVE INDEX OF CALCIUM OXIDE AND STRONTIUM OXIDE Final Scientific Report

Everett F. Sieckmann 24 Mar. 1970 6 p

(Grant AF-AFOSR-634-66)

(AD-706116; AFOSR-70-0855TR) Avail: CFSTI CSCL 20/2

Single crystals of calcium oxide and strontium oxide have been produced by fusion of the powder with an electric arc in a cylindrical graphite crucible rotated on a horizontal axis at sufficient angular velocity to keep its contents thrown against the crucible walls and thus, by effectively melting the material in a crucible of its own powder, eliminating chemical reaction of the molten material with the crucible. An N2 gas jet passing through the graphite electrodes eliminated any carbide which may have formed. Optically clear crystals 1 cm x 1/2 cm x 1/2 cm were produced. Single crystals of CaO were heated in an iron bomb with Ca metal to 1200 degrees to 1300 degrees for several hours. This treatment introduced color centers into the CaO single crystals, the density of which, depended on the exact coloring temperature and the density of Ca atoms above the crystal. Crystals colored in this way were ground into prisms and their refractive index was studied as a function of the density of color centers in the crystal. Strontium oxide colored readily when heated in a reducing atmosphere. Author (TAB)

N70-38823 California Univ., San Diego.

SUPERCONDUCTIVITY AND MAGNETISM OF LANTHANUM - RARE EARTH DIALUMINIDES

Merrill Brian Maple (Ph.D. Thesis) 1969 126 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-17471

From the initial rate of depression of transition temperature (T sub c) of LaAl2, a relative s-f coupling parameter was determined for the rare earths (RE). This is compared with the relative s-f coupling parameter derived from nuclear magnetic resonance and electron paramagnetic resonance measurements on the isostructural (RE)Al2 compounds. Normal state magnetic susceptibility measurements on La sub 1-x Gd sub x A12 alloys above n sub cr indicate ferromagnetic order. The depression of T sub c of LaAl2 by Ce impurities is anomalously large. Moreover, the dependence of T sub c on pressure for La sub 1-x Ce sub x Al2 alloys varies markedly with Ce concentration, whereas it is independent of Gd concentration in the La sub 1-x Gd sub x A12 system. These anomalies are discussed in terms of interband mixing of Ce 4f states with conduction band states. The effect of crystal fields is also discussed and reference is made to the magnetic susceptibility and electrical resistivity of CeAl2. Dissert. Abstr.

N70-38914# State Univ. of New York, Stony Brook. Dept. of Electrical Sciences.

THERMAL LENS EFFECT IN CdS

Gary L. Thomas and Bhushan L. Sopori 22 Sep. 1969 8 p refs Revised

(Grant AF-AFOSR-1116-66)

(AD-706819; AFOSR-70-1563-TR) Avail: CFSTI CSCL 20/12

In this paper a theory is presented to explain the observed lens effect produced by a photocurrent in CdS. An applied dc voltage causes local heating due to the presence of a localized photocurrent produced by a focused laser beam. The local heating causes an increase in the index of refraction and hence focusing. The theory predicts that the magnification should be linear in the power dissipated by the photocurrent and these predictions fall very near the measured values of magnification for different values of photoconductance, with no fitted parameters. In order to explain the threshold effect observed in some CdS samples the change in the index of refraction with temperature of CdS is measured over a temperature range of 20 degrees-350 degrees and is found to be dn/dT = 0.00015/degree C. Author (TAB)

N70-38949 California Univ., Riverside.

LOW TEMPERATURE HEAT CAPACITY MEASUREMENTS ON THE TRANSITION METAL OXIDES RuO_2 AND IrO_2

AND ON THE INSULATING MAGNETIC MATERIALS MnS, EuS AND EuTe
Burr Charles Passenheim (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-19128

The heat capacity for ruthenium dioxide and iridium dioxide was measured from .54 K to 10 K and was found, in both cases, to be characteristic of metals. At He-3 temperatures each material also exhibited a nuclear quadrupole contribution to the heat capacity due to the alignment of the nuclear quadrupole moments in the crystal field gradient. Comparing the electronic coefficient of the heat capacity to measured paramagnetic susceptibility indicates that the exchange enhancement factor of the paramagnetic susceptibility is at most 1.8 for RuO2 and 3.1 for IrO2. MnS, and EuTe are antiferromagnetic insulators, while EuS is a ferromagnet. The transition temperature of EuTe is (9.81 + or − .05) K. All crystallize in an NaCl type structure. The magnetic ions in MnS and EuTe lie in alternate ferromagnetically aligned planes and are thus face centered cubic type-2 antiferromagnets. Dissert. Abstr.

N70-38994 Arizona Univ., Tucson.
THE DENSEST LATTICE PACKING OF TETRAHEDRA
Douglas John Hoylman (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-18404

The greatest possible densities for lattice packings of tetahedra and cubooctahedra are found by the methods outlined by Minkowski. The fact is used that a densest lattice packing for a given convex body is given by a critical lattice for the corresponding difference body. If T is the regular tetahedron with vertices (-1,1,1), (1,-1,1), (1,1,-1), and (-1,-1,-1), then its difference body is the cubooctahedron K described by simultaneous inequalities. According to the results of Minkowski, an admissible lattice is critical for K if it has as a basis A,B,C such that A, B, C, and either A - B, B - C and C - A or A + B, B + C and C + A are on the boundary of K. All possible ways in which either set of six lattice points can be distributed among the fourteen faces of K are considered, with the restrictions imposed by requiring that all other lattice points except the origin not be interior to K, and in each case the smallest possible value for the determinant of Lambda is found. Dissert. Abstr.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-37640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JET ENGINES AND FUELS
V. N. Zrelov et al 20 Feb. 1970 318 p refs Transl. into ENGLISH from the Russian
(AD-706167; FTD-HT-23-244-69) Avail: CFSTI CSCL 21/5

The report covers the effect of jet fuels on service properties of modern jet aircraft engines. Reasons for poor engine performance due to fuel are given and problems discussed on improvement of technical characteristics of engines and aircraft and extension of service life by using new and improved high quality fuels. A new method for improving jet fuel purity by coagulant additives is given. A reliable means of improving operation of fuel regulating devices is mentioned and an effective means for decreasing wear of plunger type fuel pumps and regulators by use of antiwear additives is given. Antifreeze additives which prevent fuel filter obstruction at high altitudes is discussed. Relationship of engine operation to fractional composition and volatility of fuels is described. Author (TAB)

N70-37694# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF LOW-VELOCITY DETONATION PHENOMENA IN LIQUID PROPELLANTS. FUELS AND EXPLOSIVES Annual Report, 1 Mar. 1969 28 Feb. 1970
D. C. Wooten, H. R. Bredfeldt, R. W. Woolfolk, and R. J. Kier 30 Mar. 1970 71 p refs
(Contract F44620-69-C-0079)
(AD-706921; AFOSR-70-1005TR) Avail: CFSTI CSCL 19/4

A reevaluation is made of existing low-velocity detonation (LVD) data to identify individual mechanisms contributing to LVD initiation and propagation in energetic liquid explosives. LVD is observed only in confined explosives. Container walls induce cavitation in the liquid ahead of a shock which compresses the cavities to produce hot spot ignition of the material. The wall interaction is investigated theoretically to show that precursor pressure waves of sufficient strength to cause cavitation are present. Properties of systems that influence LVD are examined and compared to observed phenomena. Experiments to examine the effects of confinement are described. Wall thickness is varied, keeping all other parameters constant. The results indicate that for a given system there is probably a single critical wall thickness that will support stable LVD. TAB

N70-37786*# Vitro Labs., Silver Spring, Md.
RAPID LINEAR PYROLYSIS OF COMPOSITE SOLID PROPELLANT INGREDIENTS
Donald R. Simon Sep. 1970 29 p refs
(Contract NAS1-8450)
(NASA-CR-66856) Avail: CFSTI CSCL 21I

Polymeric materials have been exposed to high levels of surface heat flux (up to 1,000 cal/sq cm/sec) and the resulting linear regression rates (up to 3 mm/sec) measured. A novel microthermometry technique was developed to measure the subsurface temperature distributions and applied successfully in obtaining linear pyrolysis characteristics of polymethylmethacrylate. All polymeric materials tested exhibited a liquid layer on the regression surface; and or polymethylmethacrylate it appeared to increase in thickness with increasing surface heating rate (and therefore regression surface regression rate). Although not reported in the earlier literature, it is mentioned frequently in recent publications. No linear pyrolysis model exists that accounts for it directly, but its presence could strongly influence combustion characteristics of systems of practical interest; for example, composite solid propellants Author

N70-37958*# Bellcomm, Inc., Washington, D.C.
STATISTICAL ANALYSIS OF PROJECT PYRO LIQUID PROPELLANT EXPLOSION DATA
P. Gunther and G. R. Andersen 23 Jul. 1969 211 p
(Contract NASw-417)
(NASA-CR-113114; TM-69-1033-3) Avail: CFSTI CSCL 21I

In order to obtain approximate unconditional predictions of yield, allowing for self-ignition, a statistical regression analysis was employed which combined Project Pyro's small scale, primarily controlled ignition tests with their large scale, primarily self-ignited tests. Two cryogenic propellants were studied, LO2/RP-1 and LO2/LH2, and two failure modes, confined by missile (CBM) and confined by ground surface (CBGS). Also analyzed were the small scale tests conducted to determine the effect of variables other than weight: tank and orifice geometry and ullage volume for CBM, and missile fall-back velocity for CBGS. The results of the regression analyses were mixed, and generally reflect various limitations inherent in the data. Summaries for each of the four propellant-failure mode combinations are given. Techniques are

developed for estimating yield through a least squares fit of the peak overpressure and impulse observations to TNT calibration curves, and also for determining whether departures from such curves are significant. A detailed analysis shows that over three-fourths of the tests did in fact depart significantly. Author

N70-38250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMODYNAMIC CALCULATION OF REACTION-TYPE COMBUSTION CHAMBERS, FUNCTIONING ON A FUEL OF THE TYPE C(C)H(H)O(O)N(N) WITH A COEFFICIENT OF EXCESS OXIDIZER GREATER THAN 1

I. P. Goldayev et al 3 Feb. 1970 11 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 11 1967 p 11-16

(AD-706172; FTD-HT-23-603-69) Avail: CFSTI CSCL 21/2

A method is presented for the thermodynamic calculation of fuel burning at constant pressure. The expansion of the combustion products to a given pressure on the edge of the nozzle takes place isentropically. The authors state that utilization of the proposed method, thermodynamic calculation can be performed with a specified coefficient of excess oxidizer for fuel containing carbon, hydrogen, oxygen, and nitrogen. TAB

N70-38458# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.

STORAGE STABILITY OF HIGH TEMPERATURE FUELS. PART 3: THE EFFECT OF STORAGE UPON THERMALLY INDUCED DEPOSITION OF SELECTED FUEL COMPONENTS AND ADDITIVES Technical Report, Mar. 1969 - Mar. 1970

Marvin L. Whisman, John W. Goetzinger, and Cecil C. Ward Jun. 1970 96 p refs

(Contract F33615-67-M-5003)

(AD-707524; AFAPL-TR-68-32-Pt-3) Avail: CFSTI CSCL 21/4

The investigation was concerned with the contribution of selected components and additives of high-temperature aircraft fuels to thermally induced deposits before and after 52 weeks storage at 130F. Of particular concern is the influence of these fuel constituents on thermal stability quality of these jet fuels during storage. The study utilizes a microfuel coker test apparatus to measure the thermal stability of test fuels and blends. The contribution of selected fuel components, labeled with carbon-14, to deposit-forming mechanisms is determined by radioactive counting techniques. Twenty-eight blends of the five test fuels with carbon-14-labeled fuel additives or components reached the final stage of storage at 130F and received final analyses for deposit forming tendency. These additives included an amine-type antioxidant, a metal deactivator, and a corrosion inhibitor. Also included in this study group were oleic acid and 1,5-hexadiene. All three additives showed a great tendency to degrade and react during storage and thermal stress. It was found that oleic acid interacts with cadmium present in aircraft fuel systems to produce deleterious effects upon the thermal stability quality of the fuel. Results showed changes in thermal stability quality of many of these blends containing sulfur compounds. Four additional special studies were conducted as preliminary investigations to continued research of jet fuel stability characteristics. Author (TAB)

N70-38461# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMBUSTION OF HEAVY LIQUID FUELS

L. V. Kulagin et al 7 Apr. 1970 287 p refs Transl. into ENGLISH from the Russian

(AD-707302; FTD-HT-23-927-68) Avail: CFSTI CSCL 21/2

The book is intended for the engineers working in the field of liquid-fuel combustion control and also for advance students in related courses of study. The fundamental laws governing liquid-fuel atomization and combustion are discussed and optimal combustion conditions are analyzed. The combustion characteristics of individual fuel droplets, as functions of the external conditions and fuel properties, the droplet combustion process in a flame length and the quality of atomization are examined. In addition, atomization quality is covered, and nozzle systems and the construction of nozzles are analyzed. Methods of designing centrifugal and pneumatic nozzles, and methods of controlling atomization fineness and the quality of the combustion process are also offered. Author (TAB)

N70-38503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL DECOMPOSITION AND EXPLOSION OF AMMONIUM PERCHLORATE AND AMMONIUM PERCHLORATE PROPELLANT UP TO FIFTY KILOBARS

Hans R. Voelki Washington Sep. 1970 23 p refs

(NASA-TN-D-6013; E-4568) Avail: CFSTI CSCL 21I

The rates of thermal decomposition of ammonium perchlorate and an ammonium perchlorate solid propellant at 15, 25, and 50 kilobars pressure were studied in a cubic anvil press. The data were correlated by first order rate equations to obtain the temperature variation of the specific reaction rates and the apparent activation energies. Explosion limits of pure ammonium perchlorate are included to 30 kilobars. Electrical resistance measurements of this salt at high pressure were also made. Author

N70-38606# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.

EFFECT OF FUEL COMPOSITION ON EXHAUST EMISSIONS FROM A SPARK IGNITION ENGINE

Ralph D. Fleming 23 Sep. 1970 73 p refs

(BM-RI-7423) Avail: CFSTI

A single-cylinder research engine was operated on pure hydrocarbons and two-component mixtures of pure hydrocarbons to study the effect of fuel compositon on exhaust emissions from a spark-ignition engine. Three pure hydrocarbons that represented the primary hydrocarbon types present in commercial motor fuels were used: a paraffin, an olefin, and an aromatic. The engine was operated at the same equivalence ratio for all of the fuels used in the experiment. Exhaust gas samples were collected and quantitatively analyzed for carbon monoxide, carbon dioxide, hydrogen, nitrogen oxides, aldehydes, and hydrocarbons. Exhaust hydrocarbons were separated and quantitatively measured with a chromatographic system employing a flame-ionization detector. Unknown hydrocarbons and oxygenated materials in the exhaust were identified with a time-of-flight mass spectrometer coupled to a chromatographic system. Author

N70-38747# Aerospace Corp. El Segundo, Calif. Aerodynamics and Propulsion Research Lab.

ROCKET PLUME (N2O4/MMH) IMPINGEMENT ON AN ALUMINUM SURFACE

Hideyo H. Takimoto and Genevieve C. Denault 15 Mar. 1970 21 p refs

(Contract F04701-69-C-0066)

(AD-707109; TR-0066(5210-10)-7; SAMSO-TR-70-191) Avail: CFSTI CSCL 21/9

The high-speed impact of combustion residues from a N2O4-MMH rocket motor on an aluminum bar placed in the plume 4 ft downstream of the nozzle resulted in an erosion of the polished metal surface. Craters approximately 8 microns in diameter in the core and 2 microns toward the outer boundary of the plume were observed. Although a larger quantity of products was found in the center region, craters were more numerous yet smaller in size in the periphery of the plume. The combustion residues appear to travel in a straight line after leaving the rocket nozzle. A

protective covering of filter paper placed on certain sections of the aluminum bar was sufficient to cushion the impact of the exhaust particles, leaving the polished metal surface unmarked even near the center of the plume. The major product found on the surface was identified by infrared and differential thermal analyses as monomethylhydrazinium nitrate. Author (TAB)

N70-38865 Wisconsin Univ., Madison.
THE PREKNOCK KINETICS OF ETHANE IN A SPARK-IGNITED ENGINE
David Karl Trumpy (Ph.D. Thesis) 1969 297 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.85 Order No. 69-12424

The possibility of using kinetic rate equations to predict the occurrence of knock is considered and the analytically predicted time of knock using these equations is compared with the time of knock as measured from a CFR engine operating at medium knock with ethane-air mixtures. Using the null infrared radiation technique for an initial measured value, the temperature of the end gas is computed using an energy balance which accounts for chemical energy release, compression, and heat transfer from a unit mass of end gas. The concentrations of 28 species are predicted by numerically integrating, with a predictor-corrector subroutine, the 28 differential equations resulting from a 75 reaction mechanism for the oxidation and decompositioon of ethane. The initial values of concentrations are specified from previous computations and include the concentrations of ethane, oxygen and nitrogen. Dissert. Abstr.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-37672# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ENERGY SOURCES OF AVIATION ENGINES
Pin-Chuan Chang 15 May 1970 8 p Transl. into ENGLISH from Hang K'ung Chih Shih (Communist China), no. 7, 1960 p 16
(AD-707178; FTD-HT-23-213-70) Avail: CFSTI CSCL 21/4

After reviewing the properties and limitations of chemical fuels such as gasoline, solid fuel and hydrogen fuel, the report discusses the possibilities of ionic fuel and nuclear fuel, and their existing problems of application to aviation. It is stressed that due to the fast scientific progress and requirements, these pending problems may soon be solved. Author (TAB)

N70-37761# Rolls-Royce, Ltd., Derby (England).
ENGINE PERFORMANCE CONSIDERATIONS FOR THE LARGE SUBSONIC TRANSPORT
B. Wrigley *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 15 p (See N70-37753 21-01)
Avail: CFSTI

The relative importance of the design point parameters and factors influencing off-design performance are discussed. The parameters of importance are identified as the overall compressor total pressure ratio, turbine entry total temperature, component efficiency level, by-pass ratio, and fan total pressure. The limitations on the choice of thermodynamic cycle are outlined, and the interaction between by-pass ratio and fan total pressure ratio is described. Engine matching and off-design performance of a high by-pass engine are discussed with respect to turbine entry total temperature and mixed exhausts, and transient performance, windmilling, and sensitivity to offtakes and losses are considered. N.E.N.

N70-37762# Rolls-Royce, Ltd., Derby (England).
THE AERODYNAMICS OF ENGINE COMPONENT DESIGN PROBLEMS ASSOCIATED WITH LARGE SUBSONIC AIRCRAFT
R. Hetherington *In* AGARD High Reynolds Number Subsonic Aerodynamics Jun. 1970 37 p refs (See N70-37753 21-01)
Avail: CFSTI

Design considerations are discussed for the individual components of fan, gas generator multistage compressors, the LP turbine, and the HP turbine. Engine geometry, aspect ratio, intercompressor and inter-turbine ducts, air intake, inlet maldistribution, noise and model testing and ascale effects are included. Design techniques and computational procedures are described in general, and in particular for through flow analysis, blading techniques in turbines, and compressor blading at high incident Mach numbers. N.E.N.

N70-37980* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET ENGINE Patent
Edward A. Richley, Eugene E. Dangle, and Jerrold D. Wear, inventors (to NASA) Issued 28 Jan. 1964 (filed 4 Oct. 1960) 8 p Cl. 60-35.5
(NASA-Case-XLE-00342; US-Patent-3,119,232; US-Patent-Appl-SN-60531) Avail: US Patent Office

A metal ion rocket engine configuration employing surface ionization and having grid electrodes of closely spaced wires is described. Atoms such as alkali atoms are singly ionized upon contact with metal surfaces, such as tungsten or platinum. The surface must have a work function larger than the ionization potential of the atom, and the surface temperature must be high for the atom to remain only a short time. Electrons on the surface are pumped back into the ion beam, neutralizing it and preventing charge accumulation. The alkali metals are loaded into small glass ampules, which are placed into the propellant vaporizer and broken to release the propellant when desired. The temperature control and grid systems are also described. N.E.N.

N70-38138# Aerospace Corp., El Segundo, Calif. Fluid Mechanics Dept.
PREDICTIONS OF THE TERMINAL ALTITUDE AND SIZE OF LARGE BUOYANT CLOUDS GENERATED BY ROCKET LAUNCHES, 1 SEPTEMBER 1968 - 1 JUNE 1969
William S. Hart 1 May 1970 62 p refs
(Contract F04701-69-C-0066)
(AD-707110; TR-0066(5115-10)-1; SAMSO-TR-70-207) Avail: CFSTI CSCL 4/2

Motion pictures of launches of Titan III solid rocket motors were used, in conjunction with conservation equations and knowledge of rocket plume properties, to determine the initial temperature and mass of the large cloud that is generated during these launches. These initial conditions were applied to a mathematical model which accounted for buoyancy, drag, and entrainment. The model predicted the radius, altitude, temperature, and mass of the cloud as a function of time. The results showed fair agreement with size and altitude data extracted from the movies. This methodology was applied with limited success to smaller scale rocket clouds generated at test stands. The model was also used to predict the behavior of large exhaust clouds under various external temperature profiles. There is some experimental evidence that the model correctly accounts for unstable profiles, and the predictions of cloud rise during inversion conditions agree with what intuition would predict. Author (TAB)

N70-38181* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPARATUS AND METHOD FOR CONTROL OF A SOLID FUELED ROCKET VEHICLE Patent
Winston Gin, Leonard R. Piasecki, and Geoffrey Robillard, inventors (to NASA) Issued 25 Feb. eb. 1964 (filed 25 Nov. 1960) 5 p Cl. 102-49 Sponsored by NASA
(NASA-Case-XNP-00217; US-Patent-3,122,098;
US-Patent-Appl-SN-180374) Avail: US Patent Office CSCL 21H

The apparatus and method described relate particularly to terminal control of thrust for trajectory predetermination. Accurate and predetermined reduction and termination of thrust may be effected from a remote station so as to effect vernier adjustment of range and velocity of the rocket vehicle. The thrust reduction and termination are brought about without the production of transient thrust peaks or side thrusts. The control takes place in two stages. First, the nozzle is separated on command from the rocket motor chamber to reduce chamber pressure and hence thrust. Secondly, the motor chamber itself is separated on command from the remaining components of the rocket vehicle and consequently is caused to decelerate. The rocket vehicle payload structure, motor structure containing a solid propellant, and nozzle structure are discussed. P.A.B.

N70-38197* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF PRODUCING POROUS TUNGSTEN IONIZERS FOR ION ROCKET ENGINES Patent
Neal T. Saunders, inventor (to NASA) Issued 21 Jul. 1964 (filed 18 Jun. 1962) 7 p Cl. 75-222
(NASA-Case-XLE-00455; US-Patent-3,141,769;
US-Patent-Appl-SN-203409) Avail: US Patent Office CSCL 21C

A method is described for producing a thin, porous tungsten plate which permits the flow of cesium vapors during operation of an ion engine at temperatures of 2000 to 2500 F for long periods. Comminuted tungsten is reduced to a particle size with an average diameter from 0.01 to 1.0 micron. The powder is then mixed with long chain fatty acid, preferably stearic acid. The mixture is pressed and sintered to produce the ionizer platelets which provide a high propellant utilization efficiency in ion engines. R.B.

N70-38199* National Aeronautics and Space Lewis Research Center, Cleveland, Ohio
ROCKET ENGINE INJECTOR Patent
Samuel Stein, inventor (to NASA) Issued 9 Jun. 1964 (filed 20 Aug. 1959) 4 p Cl. 60-39.48
(NASA-Case-XLE-00111; US-Patent-3,136,123;
US-Patent-Appl-SN-835152) Avail: US Patent Office CSCL 21H

A system is described for feeding fuel and oxidants through an injector into a rocket engine combustion chamber and providing adequate atomizing and mixing to insure maximum combustion efficiency. The two fluids are mixed at the plane of entry, which provides atomization and violent mixing due to turbulence and diffusion of unlike liquid streams in a coaxial flow. R.B.

N70-38249* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IGNITION SYSTEM FOR MONOPROPELLANT COMBUSTION DEVICES Patent
John J. Chilenski, inventor (to NASA) Issued 11 Feb. 1964 (filed 3 Mar. 1962) 4 p Cl. 60-35.6 Sponsored by NASA
(NASA-Case-XNP-00249; US-Patent-3,120,738;
US-Patent-Appl-SN-180391) Avail: US Patent Office CSCL 21H

An ignition system is described in which a predetermined charge of an oxidizer is introduced into the combustion chamber of the device simultaneously with initial introduction of the monopropellant to produce a hypergolic action. This instantly ignites the catalyst bed as to ignite and sustain decomposition of the monopropellant. The ignition system is lightweight and free of moving parts, except for valves, and is therefore particularly adapted for use in rocket vehicles. It is capable of operation irrespective of gravity conditions or atmospheric pressure, including conditions of zero gravity and zero pressure. P.A.B.

N70-38504* FMC Corp., New York.
DECOMPOSITION UNIT Patent
Andrew J. Kubica and Noah S. Davis, inventors (to NASA) Issued 2 Jun. 1964 (filed 29 Sep. 1961) 5 p Cl. 60-35.6 Sponsored by NASA
(NASA-Case-XMS-00583; US-Patent-3,135,089;
US-Patent-Appl-SN-182699) Avail: US Patent Office CSCL 21H

A unit for the rapid and reliable catalytic decomposition of hydrogen peroxide is described for reaction engines on high altitude aircraft and space vehicles. The unit is elongated, and has a hydrogen peroxide supply system and two chambers in series with catalyst bed. The fuel is directed from the supply tube radially outwards in the first decomposition chamber. This creates an area of substantially stagnant fuel at the upstream end of a catalytic screen. The fuel remains in contact with the catalyst long enough to decompose. The heat of decomposition increases the local temperature, and heats the entire chamber. As the chamber is heated, more fuel is decomposed giving off more heat. This aids the decomposition in the second chamber as the flow progresses through the second catalytic bed. N.E.N.

N70-38505* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET MOTOR SYSTEM Patent
David M. Straight and John W. Gregory, inventors (to NASA) Issued 2 Jun. 1964 (filed 30 Mar. 1962) 6 p Cl. 60-35.6
(NASA-Case-XLE-00323; US-Patent-3,135,090;
US-Patent-Appl-SN-183977) Avail: US Patent Office CSCL 21H

An igniter capsule for chemically igniting the liquid propellant of a rocket engine is described. The capsule is mounted next to the combustion chamber on the injector for introducing liquid chemicals, such as chlorine trifluoride, into the chamber independently of the fuel flow. Details of the capsule assembly, discharge control, and sealing are presented. N.E.N.

N70-38574# Naval Air Propulsion Test Center, Philadelphia, Pa.
INVESTIGATION OF NEW METHODS OF FLUID FILTRATION, PHASE A REPORT
Rudolph E. Harrer Jun. 1970 57 p refs
(AD-707058; NAPTC-AED-1933) Avail: CFSTI CSCL 13/11

The document is concerned with new methods of filtration for aircraft fuel systems, presenting a study of the vortex separator principle. The report discusses its basic principles of operation and the calculated performance of the separator in specific engine fuel systems. Author (TAB)

N70-38645* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STEERABLE SOLID PROPELLANT ROCKET MOTOR Patent
Carl W. Raggio, Jr., inventor (to NASA) Issued 7 Jul. 1964 (filed 31 Oct. 1961) 6 p Cl. 60-35.54 Sponsored by NASA
(NASA-Case-XNP-00234; US-Patent-3,139,725;
US-Patent-Appl-SN-180382) Avail: US Patent Office CSCL 21H

The propellant chamber is essentially spherical in form and is provided with a main nozzle extending partly into the chamber and four equally spaced laterally directed steering nozzles. These nozzles are clustered around the outwardly projected protion of the main nozzle and are connected with the chamber by ducts terminating adjacent to the main nozzle. Associated valve means, adapted to withstand the heat generated by the solid propellant combustion products, are arranged for remote control so that laterally directed thrusts of selected duration may be made during motor operation to guide the vehicle. The chamber body is filled with a solid propellant charge which has a central bore coaxial

with the main nozzle. An annular flow passage external of the main nozzle is formed leading to the diverter ducts. Pressure for steering control is available the instant pressure develops in the propellant chamber. The steerable rocket motor described is particularly adapted for use as the final or intermediate stage of a multiple stage rocket to effect orientation of the rocket payload, or as a retrorocket to reduce vehicle velocity. P.A.B.

N70-38710* National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
INJECTOR FOR BIPROPELLANT ROCKET ENGINES Patent
Marcus F. Heidmann, inventor (to NASA) Issued 3 Mar. 1964 (filed 19 Jun. 1961) 7 p Cl. 60-35.6
(NASA-Case-XMF-00148; US-Patent-3,122,885; US-Patent-Appl-SN-118202) Avail: US Patent Office CSCL 21H

A wafer-like, checkerboard, fuel injector assembly which delivers the liquids so that one acts as an internal coolant is described. The assembly has manifolds for each of the propellants; the manifolds are in-line and form a portion of the rocket engine. The fuel manifold connects with a coolant chamber between the manifold and the injector face plate so that fuel flows over and cools the rear face of the injector plate. The propellant manifolds are maintained at near stagnation conditions, permitting uniform orifice pressure drop, metering, mass distribution, and controlled mixture distribution across the injector face. The oxidant propellant is supplied to the combustion chamber through short straight injection tubes, also permitting a uniform pressure drop and forming a jet of known characteristics. N.E.N.

N70-38711* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PENSHAPE EXHAUST NOZZLE FOR SUPERSONIC ENGINE Patent
James F. Connors, inventor (to NASA) Issued 12 Mar. 1963 (filed 6 Jan. 1960) 8 p Cl. 60-35.55
(NASA-Case-XLE-00057; US-Patent-3,080,711; US-Patent-Appl-SN-914) Avail: US Patent Office CSCL 21E

An exhaust nozzle with circular end projections and easily controllable throat area modulation is described. The throat area modulation is caused by either a movable single or double ramp structure in the nozzle exit or a movable clamshell element at the lip of the nozzle exit. The design provides high nozzle efficiencies, high thrust coefficients over a wide range of nozzle pressure ratios and flight conditions, the favorable external expansion features of a plug nozzle, low afterbody drag, and an exit particularly suited for supersonic turbojet and rocket-type jet engines. N.E.N.

N70-38751*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COOLANT FLOW EFFECTS ON THE PERFORMANCE OF A CONICAL PLUG NOZZLE AT MACH NUMBERS FROM 0 TO 2.0
Robert J. Jeracki and Francis C. Chenoweth Washington Sep. 1970 50 p refs
(NASA-TM-X-2076; E-5552) Avail: CFSTI CSCL 21H

The effect of film cooling on nozzle performance was evaluated for three cooling slot locations on the plug surface: one upstream and two downstream of the nozzle throat. An additional configuration simulated a convectively cooled plug truncated to half-length with the coolant flow dumped into the plug base. The primary throat was maintained in the maximum afterburning position with a throat to nacelle area ratio of 0.36. All configurations had nozzle efficiencies within 1.5 percent of each other at takeoff and at three important acceleration conditions. These configurations typically provided nozzle efficiencies of 99 percent at takeoff, 95 percent at Mach 1.2, and 97 percent at Mach 1.97. The coolant slop upstream of the throat generally provided the highest nozzle efficiency but also required the highest coolant pressures. Author

N70-38769# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL PROBLEMS OF SPACE THRUST POWER ENGINEERING
V. P. Burdakov et al 13 May 1970 28 p refs Transl. into ENGLISH from the Russian
(AD-706659; FTD-MT-24-420-69) Avail: CFSTI CSCL 21/8

The book has a survey character and is dedicated to an urgent subject - power safeguard of promising thrust systems of spacecraft. This is one of the first attempts to give a full account of contemporary views on the possibility of use in thrust systems of external mass-energy resources. Much attention is paid to new principles of creation of space thrust systems, in particular, to the use of the surrounding medium and interaction of spacecraft with external electrical and magnetic fields. For the first time extensive data on power and mass resources of circumsterrestrial space are collected and systematized. A brief familiarization with atomic sources of energy sufficiently compact and energy consuming shows the reality of safeguard of the energy of these systems. The book introduces the reader to a complex new region, but its material is based on well-known physical phenomena and processes and, therefore, is accessible to a wide circle of persons with the usual college student preparation. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-37751# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVATIONS OF PROTON BURSTS IN THE MAGNETOTAIL WITH EXPLORER 35
Joseph Fennell Jun. 1970 41 p refs
(Contract N00014-68-A-0196-0003)
(AD-707405; Rept-70-28) Avail: CFSTI CSCL 4/1

Energetic proton bursts (proton energy greater than or equal to 32 MeV) are observed at 60 Earth radii in the magnetotail by Explorer 35. The intensity is usually anisotropic. The net proton flow as measured in the ecliptic plane is found to be most often, but not always, nearly parallel or antiparallel to the local magnetic field, and is sometimes toward and sometimes away from the earth. The protons are usually observed during high-latitude magnetic bay activity at the earth. Companion observations outside the bow shock by Explorer 33 show that the proton bursts are not of solar origin. One observation evidences possible proton flow away from the earth, across the neutral sheet, and back toward the earth parallel to the field in the ecliptic plane. The proton bursts have spectral e-folding energies of 50-110 keV and peak intensities of 14-420/(sq.cm sec ster), values that are similar to those for protons near the outer-zone trapping boundary. Author (TAB)

N70-37991# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
A RADIO INTERFEROMETRIC TEST OF THE GENERAL RELATIVISTIC LIGHT BENDING NEAR THE SUN
D. O. Muhleman, R. D. Ekers, and E. B. Fomalont 1970 20 p refs Submitted for publication
(Contract N00014-67-A-0094-0008)
(AD-706312; Rept-1970-5) Avail: CFSTI CSCL 20/10

Radio interferometry was used to measure the deflection of a radio source as it passed the Sun. This deflection is a separable combination of refraction in the coronal electron plasma and the General Relativistic effect. The observed inverse distance

component was 1.04(+0.15/-0.10) of that predicted by Einsteins theory of General Relativity. The observation also yielded a reasonable value for the coronal electron density. Author (TAB)

N70-37997# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
INVESTIGATIONS OF THE DYNAMICS OF IONIZED AND NEUTRAL ATMOSPHERES Final Report, 1 Jun. 1967 31 Dec. 1969
Victor P. Starr, ed. 31 Jan. 1970 182 p refs
(Contract F19628-67-C-0229)
(AD-707123; AFCRL-70-0146) Avail: CFSTI CSCL 3/2

The aim of our solar studies at M.I.T. is to render aid in the prediction of solar activity and its effects in the ionosphere and contiguous regions inside and outside of the terrestrial atmosphere. The general circulation of the outer layers of the sun creates areas of disturbance, mainly the active regions, which contain various manifestations such as sunspots, flares, other magnetic phenomena, and, notably, emanations to space. These emanations propagate through the region between the sun and the earth and, in addition to radiation, contain particle emmissions, shock waves in the solar wind, and associated magnetic effects. These propagations strike the terrestrial atmosphere and produce various important manifestations such as aurorae and kindred effects in the ionosphere, disturbances in the earths magnetic field, and changes in the trapped energy in the Van Allen belts. Our program of studies at M.I.T. has aimed at the comprehensive investigation of all links in this chain of effects. The phase of the effort described in this final report deals with the relationship of the solar general circulation and the development of active regions. Author (TAB)

N70-38006# Air Force Cambridge Research Labs., Bedford, Mass.
THE STRUCTURE AND DEVELOPMENT OF A SUNSPOT GROUP ON 4–8 JULY 1966
N. V. Steshenko Apr. 1970 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Krymskaya Astrofizicheskaya Observ., no. 69, 1969 p 245–252
(AD-707486; AFCRL-70-0213; AFCRL-TRANS-74) Avail: CFSTI CSCL 3/2

The structural peculiarities of a group of sunspots during its growth are investigated on the basis of photoheliograms obtained with high resolution. The group is characterized by the complex structure and rapid change in the umbrae of the sunspots. A comparison of the position of filaments of the penumbra with the charts of the transverse magnetic field obtained by A. B. Severnyy and T. T. Tsap shows a generally good agreement in the orientation of the filaments and the field. This is an additional confirmation of the fact that an investigation of the fine structure of spots from direct photographs of the Sun can give supplementary information on the structure and evolution of the strong magnetic field. Author (TAB)

N70-38330# Michigan Univ., Ann Arbor. Dept. of Physics.
INVESTIGATION OF RADIO PULSES PRODUCED BY RADIATION IN THE ATMOSPHERE Final Report
Wayne E. Hazan 28 Feb. 1970 6 p
(Grant AF-AFOSR-1460-68)
(AD-706927; Rept-01370-F) Avail: CFSTI CSCL 4/1

Radio pulses generated in the atmosphere by cosmic-ray air showers have been studied at an altitude of 17,500 feet at Mt. Chacaltaya, Bolivia. The frequency range was 40 to 180 MHz. The relationships between the radio pulses and various properties of the showers were determined. Author (TAB)

N70-38336# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
SHORT-TERM PREDICTIONS ON THE COURSE OF POLAR CAP ABSORPTION, PART 1 Final Report, 1 Apr. 1968 31 May 1969
Leif Owren Dec. 1969 127 p refs
(Contract F19628-68-C-0308)
(AD-706410; AFCRL-69-0541-PT-1) Avail: CFSTI CSCL 4/1

The physical and empirical facts of polar cap absorption (PCA) produced by solar proton events are reviewed. A description of PCA, its measurement, and the solar-terrestrial environment is included. The physical conditions of the lower ionosphere during PCA are discussed together with the frequency law of PCA, nightime recoveries, the polar cap distribution of absorption, and arctic HF propagation during PCA. A procedure for short-term prediction of the future course of PCA is developed, based on single frequency riometer measurements and computer processing of the data. The application of the prediction technique is illustrated by a detailed discussion of two PCA events. It is concluded that for most PCA events satisfactory short-term predictions can be made from riometer observations. TAB

N70-38382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLAR COSMIC RAYS
L. I. Dorman et al 1 Apr. 1970 149 p refs Transl. into ENGLISH from the publ. 'Solnechnyye Kosmicheskiye Luchi' Moscow, Izd. Nauka, 1968 p 82–185
(AD-707102; FTD-MT-24-12-70) Avail: CFSTI CSCL 3/2

The book represents a systematic organization and analysis of general experimental material on solar cosmic rays which was obtained in the period 1942-1967 by means of surface apparatus for continuous recording of cosmic rays (neutron monitors, ionization chambers, counter and scintillation telescopes) and also from data obtained by stratospheric, satellite, and rocket measurements. The basic attention is concentrated on questions of the generation and propagation of solar cosmic rays. In particular, a detailed consideration is made of the question of the shape of appearance of energy spectra of solar particles (the power and exponential function of hardness) and the dependence of the diffusion coefficient on particle energy and distance to the sun is discussed. A special chapter is concerned with certain problems in the physics of solar flares and the generation of cosmic rays on the sun. In particular the possibility of predicting flares which will emit powerful fluxes of energetic solar particles is discussed. A separate section is concerned with problems of protecting cosmonauts from solar flare protons during space flights. In the Conclusions certain experimental and theoretical problems for future study of solar cosmic rays are enumerated. Author (TAB)

N70-38517# Columbia Univ., Irvington, N.Y. Nevis Labs.
SEARCH FOR MASSIVE ELEMENTARY PARTICLES IN THE COSMIC RADIATION AT SEA LEVEL
Seth Shulman (Ph.D. Thesis) 1970 100 p refs
(Contract AT(30-1)-1932)
(NEVIS-180; R-705; CU-284) Avail: CFSTI

An experiment was performed to search for massive elementary particles in the cosmic radiation at sea level. Velocity and range measurements provided a lower limit on the mass of particles traversing the apparatus. No events corresponding to a mass of about 2 BeV/sq cm or more were found in the velocity range beta = 0.55–0.8. This result leads to an upper limit on the flux for this velocity range of 3.9 × 10 to the power of minus 9 sq cm 0.1 sr 0.1 sec. In order to interpret this flux limit in terms of a production cross section for strongly interacting massive particles, a model was developed for their production and propagation through the atmosphere. The results of this calculation, for wide variations in the model parameters, give a limit of 10–100 × 10 to the power of minus thirty sq cm on the production cross section for strongly interacting particles with a mass in the range 10–15 proton masses. Author (NSA)

N70-38565# Nuclear Energy Information Center, Warsaw (Poland).
NUCLEAR AND RELATIVISTIC ASTROPHYSICS AND NUCLIDIC COSMOCHEMISTRY, 1963 - 1967, VOLUME 1
B. Kuchowicz (Warsaw Univ.) 1968 372 p refs
(NEIC-RR-34-Vol-1) Avail: AEC Depository Libraries

The material is grouped according to the headings: major bodies of the solar system; meteorites, tektites, and cosmic dust; the stars; abundances in the galaxies and interstellar medium; nuclidic abundances in the solar system and stars; space research (general topics); solar cosmic rays; primary corpuscular cosmic radiation; X-ray and gamma-ray astronomy; nuclear energy generation and nucleosynthesis in stars; general problems in stellar structure; cosmogony of stars and planetary systems; stellar models and evolution; stellar pulsations; novae and supernovae; neutrino astrophysics; laboratory research in astrophysics; galaxies; strong radio sources and quasars; gravitational collapse; superdense matter; other applications of general relativity to astrophysics; cosmology; antimatter; elementary particles in cosmology; and the search for strange types of elementary particles. NSA

N70-38590# American Science and Engineering, Inc., Cambridge, Mass.
CELESTIAL X-RAY SOURCES Final Scientific Report
Wallace H. Tucker 15 Apr. 1970 20 p refs
(Contract F44620-67-C-0065)
(AD-706078; ASE-2377-A; AFOSR-70-0737TR) Avail: CFSTI CSCL 3/2

The research conducted under the contract is summarized. Work in the following general areas is described: (1) synchrotron models for x-ray sources, (2) the interaction of the high frequency radiation from x-ray sources with contiguous matter, (3) the secular behavior of the luminosity of x-ray sources, (4) the physical conditions in the pulsating x-ray source in the Crab Nebula, and (5) miscellaneous related topics. A bibliography of all work performed under the contract is given. Author (TAB)

N70-38633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNATIONAL SEMINAR ON THE STUDY OF PHYSICS OF INTERPLANETARY SPACE WITH THE AID OF COSMIC RAYS
V. N. Lutsenko et al 31 Mar. 1970 46 p refs Transl. into ENGLISH from the Russian
(AD-706350; FTD-MT-24-11-70) Avail: CFSTI CSCL 4/1

The document consists of two reports. The first concerns the electron component of solar cosmic rays and presents the analysis of characteristics of electron fluxes and possible mechanisms of their propagation in the interplanetary space. The second report is a brief review of the development of investigation of solar cosmic rays propagation in interplanetary space and modulation effects of galactic cosmic rays carried out in Soviet Union and abroad with the aim of obtaining the information about interplanetary conditions. TAB

N70-38911 Rice Univ., Houston, Tex.
AURORAL ZONE ELECTRON PRECIPITATION ASSOCIATED WITH ELECTRON BURSTS OBSERVED IN THE MAGNETOSPHERE AND THE MAGNETOTAIL
John Donald Pierson (Ph.D. Thesis) 1969 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-19327

A series of balloon flights was conducted from Ft. Yukon, Alaska during August 1967 to study auroral X-rays. During this period, the ATS-1 satellite was in synchronous orbit and one or more of the Vela satellites passed through the plasma sheet in the magnetotail near the midnight meridian. On August 25-26, Vela satellites 3A and 4A were near the midnight meridian at geocentric distances of approximately 17.7 and approximately 18.2 earth radii when each detected bursts of energetic electrons and variations in the plasma properties which were subsequently related to bursts of energetic electrons sensed concurrently by the ATS-1 satellite and by instruments on a balloon at 1400 local time. There were negative magnetic bays on the Leirvogur and Sodankyla magnetograms during this event. From a detailed study of this particularly complicated event several conclusions regarding the behavior of electrons in the magnetotail and in the magnetosphere were reached. Dissert. Abstr.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-37658# Colorado Univ., Boulder.
CONVECTION IN A ROTATING ANNULUS UNIFORMLY HEATED FROM BELOW
Robert P. Davis-Jones and Peter A. Gilman Apr. 1970 37 p refs
(Contract F19628-67-C-0304)
(AD-707149; AFCRL-70-0229; SR-8) Avail: CFSTI CSCL 3/2

The report discusses a linear stability analysis, to second order in initial amplitude, of Benard convection of a Boussinesq fluid in a thin, rotating annulus, for modest Taylor numbers T (= or < 10,000). The work is motivated in part by the desire to study further a mechanism for maintaining, through horizontal Reynolds stresses induced in the convection, the suns equatorial acceleration, which has been demonstrated for a rotating convecting spherical shell by Busse and Durney. The annulus is assumed to have stress free, perfectly conducting top and bottom (which allows separation of the equations) and nonconducting, nonslip sides. Annuli with gap-width to depth ratios a of order unity are considered. The close, nonslip sidewalls produce a number of effects not present in the infinite plane case, including overstability at high Prandtl numbers P, and multiple minima in Rayleigh number R on the stability boundary. The latter may give rise to vacillation. The complete second order solutions for the induced circulations indeed give faster rotation in the outer half, except for large P (> 100), in which case thermal stresses dominate. At all P, this differential rotation is qualitatively a thermal wind. Overstable convective cells, and stationary cells at higher T induce more complicated differential rotations. Author (TAB)

N70-37781# Air Force Cambridge Research Labs., Bedford, Mass.
PHOTOSPHERIC AND CHROMOSPHERIC MAGNETIC FIELDS AND THE BRIGHTNESS OF FACULAE AND FLOCULLI
T. T. Tsap Apr. 1970 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Krymsk. Astrofiz. Observ. (Moscow), no. 69, 1969 p 265 - 275
(AD-707256; AFCRL-70-0214; Trans-75) Avail: CFSTI CSCL 3/2

Photospheric and chromospheric longitudinal magnetic fields and the brightness of faculae and flocculi are compared. The connection between the brightness distribution at different depths in active regions on the sun is investigated. The following results are obtained: (1) There is a close connection between the position of faculae observed in the light of the lines 5250 and 6102.7 and flocculi observed in K3Ca(+) lines and the H(alpha) nucleus, as well as the position of the photospheric and chromospheric magnetic fields; (2) The correlation factors between the brightnesses of

flocculi in the K3 line and the H(alpha) nucleus are roughly identical with both photospheric and chromospheric fields; (3) The course of the brightness change in the case of a section through an active region in the lines 5250, 6102.7, K3 and the H(alpha) nucleus is approximately equal, although there sometimes are small deviations. The results obtained agree well with the fact that the distributions of the magnetic field in the photosphere and chromosphere are close (Severny, 1966 and 1960). Author (TAB)

N70-37880# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 232
15 Jul. 1970 131 p refs Transl. into ENGLISH from various Sino-Soviet bloc publ.
(JPRS-50941) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–5 refs (See N70-37881 21-30)
2. METEOROLOGY p 6–31 refs (See N70-37882 21-20)
3. OCEANOGRAPHY p 32–42 refs (See N70-37883 21-13)
4. TERRESTRIAL GEOPHYSICS p 43–50 refs (See N70-37884 21-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 51–122 refs (See N70-37885 21-13)

N70-37881# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space No. 232 15 Jul. 1970 p 1–5 refs (See N70-37880 21-30)
Avail: CFSTI

The operation of a new telescope at the Shemakha Astrophysical Observatory is reported. Abstracts of scientific articles include the following: altitudes of flare generation, structure of solar radio emissionbursts, structure of the interplanetary magnetic field, changes in cosmic rays during a solar cycle, cosmic ray intensity decreases, stratospheric disturbance and its possible source, two types of stratospheric warnings, wintertime stratospheric warnings, and electrically charged particle motion near the earth. P.A.B.

N70-37895# California Univ., Berkeley. Space Sciences Lab.
ECLIPSE MEASUREMENTS NEAR 1.2-CENTIMETER WAVELENGTH, 11 SEPTEMBER 1969
Mohamed El-Raey 10 May 1970 19 p refs *Its* Space Sci. Lab. Ser. 11, Issue 42
(Contract N00014-69-A-0200-1006)
(AD-707423) Avail: CFSTI CSCL 3/2

Measurements performed at wavelength 1.18 cm during the September 11, 1969, partial solar eclipse are described. No significant limb-brightening was detected. However, a high coronal contribution to the emission at this wavelength was observed. Separation between the emission from the center of a unipolar spot of diameter approximately 1/2 to 1 arc minute and its plage region of diameter approximately 3 to 4 arc minutes was possible. Author (TAB)

N70-38135# Directorate of Scientific Information Services, Ottawa (Ontario).
CONCERNING SOME PROPERTIES OF DUST IN SPACE
V. I. Krasovski May 1970 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 89, no. 5, 1953 p 805–808
(AD-707022; T-513-R) Avail: CFSTI CSCL 3/2

Any dust particle or body in space, it seems, in most cases bears an electric charge. Because of the greater mobility of negative electrons as compared with positive ions, dust particles in an ionized gas always, in the absence of light, become negatively charged. In this case their equilibrium potential is that at which the influx of positively and negatively charged particles is equalized. Calculations show that in a proton-electron plasma with a Maxwellian distribution of velocities the said equilibrium potential E sub 0 in volts approximately equals the mean energy E of the gas, in electron-volts multiplied by the square root of 10. In a plasma containing ions heavier than protons the equilibrium potential will be greater. In regions of cosmic space with a high density of radiation (for instance, in the vicinity of a star) it is more probable that dust particles will have a positive charge of a few volts potential, due to photoelectric emission. A dust particle may also acquire a charge through friction with a neutral gaseous medium, even in the entire absence of radiation. Author (TAB)

N70-38148*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EXPERIMENTAL INVESTIGATION OF ULTRAHIGH VACUUM ADHESION AS RELATED TO THE LUNAR SURFACE, FIFTH YEAR SUMMARY Final Report, 1 Jan. 1969–19 Jun. 1970
J. J. Grossman, J. A. Ryan, and M. W. Wegner 30 Sep. 1970 57 p refs
(Contract NAS7-307)
(NASA-CR-112967; MDC-G-1403) Avail: CFSTI CSCL 03B

A summary is presented of work accomplished during this period on the study of the ultrahigh vacuum adhesion of silicates as related to the lunar surface. The general purposes of this program were: (1) to obtain quantitative experimental data concerning the origin of the electrical charge distribution produced by the ultrahigh vacuum fracture of various silicate minerals and model materials, (2) to achieve an understanding of the mechanisms responsible for the observed charge stability in relationship to the lunar environment, (3) to apply etching techniques to a variety of possible lunar silicates including shock-loaded and/or radiation damaged materials, also vacuum cleaved silicates and model crystals, (4) to apply the results to further understanding of the possible effects of environment on silicate structure, in preparation for analyzing the lunar materials returned by Apollo, and (5) to attempt to obtain information concerning bonding of crystal grains in polycrystalline rocks. The approach used was to cleave silicates at ultrahigh vacuum and measure the electrostatic charge distribution produced, and obtain microchemical and microphysical profiles on the cleaved surfaces. Defect etching techniques were applied to a variety of possible lunar silicates, and the adhesion force of polycrystalline silicates fractured at ultrahigh vacuum was measured. Author

N70-38164*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL CONDUCTIVITY OF A PARTICULATE SAMPLE IN AN ENVIRONMENT THAT SIMULATES THE PLANET MARS
James A. Fountain and Ronald W. Scott 16 Sep. 1969 20 p refs
(NASA-TM-X-53919; M5FC-IN-SSL-T-68-15) Avail: CFSTI CSCL 03B

A series of thermal conductivity tests has been conducted on a particulate sample in an environment that simulates the planet Mars with respect to atmospheric constituency, pressure, and temperature range. The results establish an order of magnitude for this type of sample-environment system. The thermal conductivity lies in the range from 1.53 × 0.0001 watt/cm K at the minimum temperatures to about 2.35 × 0.0001 watt/cm K at the maximum temperatures. The effect on the thermal conductivity caused by

pressure is compared between a sample in Martian and lunar type environments. The effects of temperature cycling on the shape of the thermal conductivity curve are also discussed. Author

N70-38168*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A GENERAL SURVEY OF CLASSICAL CEPHEID VARIABLE STARS
Robert M. Wilson (Univ. of South Fla.) 16 Sep. 1969 89 p refs
(NASA-TM-X-53920; MSFC-IN-SSL-T-68-16) Avail: CFSTI CSCL 03B

Cepheid variable stars, their description, their characteristics, and their spectra are discussed. The interstellar medium, infrared radiation (history, detection, atmospheric effects), and the H-R diagram are also considered. The topics of immediate concern are Cepheids, types I and II, the light curve, the velocity curve, pulsation theory (without mathematical proof), and distance modulation. Author

N70-38213# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 234
7 Aug. 1970 44 p refs Transl. into ENGLISH from various Sino-Soviet bloc publ.
(JPRS-51121) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-4 refs (See N70-38214 21-30)
2. METEOROLOGY p 5-10 refs (See N70-38215 21-20)
3. OCEANOGRAPHY p 11-20 refs (See N70-38216 21-13)
4. TERRESTRIAL GEOPHYSICS p 21-28 refs (See N70-38217 21-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 29-39 refs (See N70-38218 21-13)

N70-38214# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 234 7 Aug. 1970 p 1-4 (See N70-38213 21-30)
Avail: CFSTI

News briefs and articles are reported on lunar mascons, azimuthal electric currents in sunspots, effects in sunspot magnetic fields, parameters of the Venusian atmosphere, and physical mapping of the moon from photometric data. R.B.

N70-38381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAT TRANSFER IN THE CONVECTIVE ENVELOPE OF THE SUN
Klaus Schocken 16 Sep. 1969 18 p refs
(NASA-TM-X-53928; MSFC-R-SSL-INT-67-8) Avail: CFSTI CSCL 03B

The heat flux in the convective layer of the sun is derived by two different methods. The first method is conventional, and starts with the condition of thermodynamic equilibrium. If in radiative equilibrium due to adiabatic expansion a rising mass of gas becomes warmer than its surroundings, its motion will continue. Under this condition convection currents are stable and can be produced only if the amount of the adiabatic temperature gradient is smaller than the radiative gradient. The convective heat flux is computed from the energy balance during convection. The second method is based upon the photon transport equation. The convective flux is derived from the equation of radiative transfer, applying to non-equilibrium photon transport processes, by substituting convective for the radiative parameters. The two formulas for the same quantity yield a relation between the temperature gradients occurring in the equations. Author

N70-38385# Wien Univ., (Austria). Analytisches Inst.
CHEMICAL COMPOSITION AND TRACE ELEMENT CONTENT OF METEORITES Final Report, 1 Mar. 1968-28 Feb. 1970
Friedrich Hecht 4 Mar. 1970 29 p refs
(Contract F61052-68-C-0040)
(AD-706923; AFOSR-70-1427TR) Avail: CFSTI CSCL 8/4

By neutron activation analysis, the trace elements Sr, Ba, Se, Te, Ta in chondrites and their separated silicate phases were determined. In a great number of stony and iron meteorites as well as in separated phases of chrondrites and iron meteorites the elements Ti, Mn, Na, Cr, Cu, Ga, Ge were determined (also by neutron activation analysis, NAA). The main and minor constituents of irons, chondrites, and their separated phases were determined, using wet-chemical macroanalysis. Some investigations by an electron-beam microprobe were carried out. In the troilite phase of the Odessa iron the mineral Mn-daubreelite could be detected. A conception on accretion of the planets from a primordial nebula and on the origin of carbonaceous chondrites is suggested. Author (TAB)

N70-38401# Illinois Univ., Urbana.
MODELS OF JUPITER'S ATMOSPHERE
Gary Charles Goodman (Ph.D. Thesis) 1969 131 p refs
(Grant NSF GP-8161)
Avail: Issuing Activity

Jovian model atmospheres are proposed, and the predictions from the models are compared with various types of available observations. The chemical composition, and brightness temperature are discussed. The positively identified molecules are considered to be hydrogen, methane, and ammonia. Other gases expected to exist are helium, neon, and water vapor. The assumptions in constructing the models were: (1) scattering of thermal radiation is negligible, (2) the flux is constant throughout the adiative portion of the atmosphere, and (3) the atmosphere is in local thermodynamic equilibrium. A short description of the ammonia molecule is included. F.O.S.

N70-38483# Institut d'Aeronomie Spatiale de Belgique, Brussels.
BACKGROUND OF A LUNAR FLIGHT [ACHTERGROND VAN EEN MAANREIS]
E. Aerts 1970 79 p In DUTCH; ENGLISH summary *Its* Aeronomica Acta No. F-16-1970
Avail: CFSTI

This review for high school students deals with various aspects of the motivation and preparation for the Apollo lunar landings. Author (ESRO)

N70-38533*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR COMPUTING EXTREMAL MAXIMUM-RANGE THRUST-LIMITED ROCKET TRAJECTORIES WITH APPLICATION TO LUNAR TRANSPORT
A. Gary Childs, Ernest S. Armstrong, and Athena T. Markos Washington Sep. 1970 44 p refs
(NASA-TN-D-5981; L-7114) Avail: CFSTI CSCL 22C

A technique is described for the effective computation of maximum range trajectories for a thrust-limited surface-to-surface rocket in a vacuum and a Keplerian gravity field. The technique is a combination of the Pontryagin maximum principle with an

initial-value algorithm for the solution of two-point boundary value problems. Application is made to lunar flight for a vehicle with an initial thrust-weight ratio of 5.0. Surface ranges obtained as a function of the percent of the vehicle weight used as fuel vary from only a few miles to almost one half the moon's circumference. Author

N70-38549*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF LAUNCH WINDOWS FROM ELLIPTICAL ORBITS FOR REPRESENTATIVE MARS MISSIONS

26 p refs

(NASA-TM-X-2093; A-3638) Avail: CFSTI CSCL 22C

Round trips to Mars were investigated to define representative launch windows (i.e., allowable staytime variations) for Mars departures from elliptical orbits and the associated propulsive velocity requirements. The 1982 inbound and 1986 outbound Venus swingby opportunities were selected for analysis and serve to demonstrate the influence of the interplanetary trajectory characteristics on the launch window propulsive velocity requirements. These velocity requirements are the sum of the Mars arrival and departure maneuvers. This report presents contour maps indicating the effects on the launch window of velocity capability, transfer technique, orbit inclination, and orbit eccentricity. Use of one-, two-, and three-impulse transfers from the Mars orbit to the Earth return trajectory were investigated. For all cases, insertion at planet arrival was into an orbit coplanar with the arrival asymptote, and any required plane change was performed during the planet departure phase. Two specific conclusions can be drawn from the results. First, as a result of the effectiveness of the three-impulse transfer in reducing the propulsive velocity requirement to a nearly constant value regardless of the orbit geometry, the orbit selection can be optimized from other considerations independent of the interplanetary trajectory considerations. Second, for highly elliptical orbits (e = 0.7) a total propulsive velocity arrival plus departure) at Mars that is 1 km/sec below the minimum coplanar requirements for circular parking orbits provides staytimes of 60 days and usually allows any orbit inclination to be used. This propulsive velocity is effectively 2 km/sec below that required for circular orbits with the same allowable staytime. In addition, whereas the circular orbits require three impulses at departure, for some missions a single impulse can be used to eject from the elliptical orbit. Author

N70-38570*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMUM TRAJECTORIES TO CIRCULAR SYNCHRONOUS EQUATORIAL ORBIT FOR SMALLER-THAN-OPTIMUM APOGEE MOTORS

Omer F. Spurlock and Fred Teren Washington Sep. 1970 28 p refs

(NASA-TN-D-5998; E-5732) Avail: CFSTI CSCL 22C

Analysis, procedure, and results are presented for maximizing payload capability for trajectories to circular synchronous equatorial orbit where the apogee motor total impulse is much smaller than optimum. The trajectories begin at launch and are numerically integrated to insertion into the final orbit. Constraints on parking orbit perigee radius and duration are included. These trajectories, unlike conventional synchronous orbit trajectories, were found to require noncircular parking orbits and large amounts of inclination reduction before the apogee burn. The analysis and procedure were also applied to the conventional circular synchronous equatorial orbit problem where the burn and coast durations are optimum. Results are presented for the Applications Technology Satellite (ATS)-E mission, which is an example of a problem where the apogee motor is small, and for the conventional case where the apogee motor is of optimum size. Author

N70-38622# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.

A CLASS OF FIXED-TIME FUEL-OPTIMAL IMPULSIVE CONTROL PROBLEMS AND AN EFFICIENT ALGORITHM FOR THEIR SOLUTION Interim Scientific Report

Elmer G. Gilbert and Gerald A. Harasty May 1970 29 p refs (Grant AF-AFOSR-814-66)

(AD-706394; AFOSR-70-1284TR) Avail: CFSTI CSCL 12/1

The paper considers a class of fixed-time fuel optimal impulsive control problems. The problem is introduced and principal theoretical results are given. The necessary conditions are shown to be similar to those of Lee and Markus. These results are used to describe a computational procedure. A computer implementation and specific numerical results are also given. Author (TAB)

N70-38629# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FLIGHT DYNAMICS: TRAJECTORIES OF FLIGHT VEHICLES

I. V. Ostoslavskii et al 2 Feb. 1970 34 p Transl. into ENGLISH from the Russian

(AD-706663; FTD-HT-23-37-70) Avail: CFSTI CSCL 1/2

In addition to the Annotation of the forewords to the first and second edition, the translation encompasses sections of the monograph dealing with the theoretical flight dynamics of three dimensional maneuvers and the calculation of the trajectory of a winged rocket aircraft. Calculation equations are given for the cchandelle; only brief descriptions are given of the half roll, Immelmann, and roll. Extensive mathematical treatment of the behavior of a rocket powered winged vehicle in the atmosphere is presented from the point of view of the variational problem of the optimum flight program. Author (TAB)

N70-38640# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.

COMPARISON OF EQUILIBRIUM SIZE DISTRIBUTIONS FOR LUNAR CRATERS

Allan H. Marcus Jan. 1970 23 p refs (Contract Nonr-4010(09))

(AD-707014; TR-135) Avail: CFSTI CSCL 3/2

Some theoretical models of crater destruction are considered to explain not only the exponent -2 of the equilibrium distribution of crater diameters, but also the density coefficient and its regional variations. Destruction of small craters appears to be governed principally by blanketing or filling by ejecta, and the equilibrium density coefficient decreases with increasing size of the largest crater affecting the region studied. Destruction of large craters seems to depend mainly on destruction of a substantial part of the crater wall by a crater of similar or greater diameter. Only certain south polar and farside continental regions appear to be saturated with craters. Author (TAB)

N70-38663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SCIENCE EXPANDS ITS HORIZONS: THE MYSTERIOUS WORLD OF THE GALAXIES

V. Ambartsumyan 27 Feb. 1970 10 p Transl. into ENGLISH from Pravda (USSR), 1 Feb. 1970 p 3

(AD-706651; FTD-HT-23-121-70) Avail: CFSTI CSCL 3/2

In recent years astro-physics has taken great strides. An important contribution to the study of the galaxies has been made by the staff of the Byurakan Astrophysics Observatory. The article deals with new discoveries in the field of astronomy. Author (TAB)

N70-38691 California Inst. of Tech., Pasadena.

THE STABILITY OF RELATIVISTIC, SPHERICALLY SYMMETRIC STAR CLUSTERS

James Reid Ipser (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-19589

The theory of the stability of a spherically symmetric star cluster against small radial perturbations is developed within the framework of general relativity. Collisions between stars in the cluster are neglected. The equation of motion governing the small radial perturbations of a spherical cluster is derived and is shown to be selfconjugate. The variational principle provides a necessary and sufficient criterion for the stability of the cluster. Also derived are much simpler, one-dimensional, sufficient criteria for stability. The stability criteria are used to diagnose numerically the stability of clusters of identical stars with heavily-truncated Maxwell-Boltzmann velocity distributions, and (2) clusters whose densities and isotropic pressures obey polytropic laws of index 2 or 3. The calculations show that a cluster of either type is unstable against collapse if the red-shift of a photon emitted from its center and received at infinity is z sub c is greater than or approximately 0.5. The cluster is stable if z sub c is less than or approximately 0.5. Two new theorems on the theory of the stability of highly relativistic stars are also presented. Dissert. Abstr.

N70-38750# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
EASEP PRESS BACKGROUND
Apr. 1969 25 p
Avail: CFSTI

This Backgrounder is published by the Aerospace Systems Division of The Bendix Corporation to familiarize the reader with the Early Apollo Scientific Experiments Package (EASEP), its origins, objectives and operation. This booklet is designed to be a quick reference and source and the reader will find a general statement of the EASEP design followed by a more detailed examination of the component systems. Author

N70-38814*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE INFERENCE OF THE PHYSICAL PROPERTIES OF THE JOVIAN ATMOSPHERE FROM PHOTOMETRY OF ECLIPSES OF THE GALILEAN SATELLITES
Michael J. Price Washington Sep. 1970 60 p refs
(NASA-TR-R-345) Avail: CFSTI CSCL 03B

The frequent eclipses of the Galilean satellites provide a simple yet powerful method for monitoring the physical structure of the Jovian Atmosphere in time, latitude, and longitude. Theoretical and observational problems involved in the use of these eclipses to scan the Jovian atmosphere are discussed. It is shown that a rather complete knowledge of the structure of the Jovian atmosphere immediately above the cloud layer may be obtained from multicolor photometry of the refraction tails of the ingress light curves of the satellites. The relevant observational data may be obtained using currently available ground based astronomical equipment. This technique for inferring the physical structure of a planetary atmosphere may be also applied to Saturn. In that case, the relatively infrequent eclipses of Titan may be utilized. Author

N70-38832 Rice Univ., Houston, Tex.
THE INFRARED CONTINUUM OF NON-THERMAL SOURCES
Douglas Erwin Kleinmann (Ph.D. Thesis) 1969 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-19310

Infrared observations of diverse non-thermal sources, including the Crab Nebula, the jet in M 87, and the Seyfert Galaxies were made and analyzed. The fit of the 1.55 micron data on the optical jet of M 87 to the extrapolation of the radio core spectrum indicates that the usual presumption of identifying the one with the other is correct. Observations of the non-stellar continuum emanating from the nuclear regions of the Seyfert Galaxies have shown these objects to be superluminous, infrared galaxies. The observations establish the nuclear, non-stellar, continuum character of the infrared light. For the infrared galaxies, the luminosity is sufficiently high, and the nuclear mass sufficiently low, to preclude a normal galactic lifetime, unless the physical laws operating in them differ from those observed on the earth. Simple thermal or non-thermal models fail to explain the spectral distribution of the power radiated by the Seyfert Galaxies. An experimental program to better define these galaxies, and determine the physical circumstances occurring in them is suggested. Dissert. Abstr.

N70-38952# Warsaw Univ. (Poland).
NUCLEAR AND RELATIVISTIC ASTROPHYSICS AND NUCLIDIC COSMOCHEMISTRY: 1963 - 1969, VOLUME 3
B. Kuchowicz 1969 265 p refs
(NEIC-RR-38) Avail: AEC Depository Libraries

Bibliographical data are presented alphabetically by author for 1966 (1453 entries) and 1967 (1308 entries) reports on nuclear and relativistic astrophysics and nuclidic cosmochemistry. E.C.

N70-38967# Warsaw Univ. (Poland). Nuclear Energy Information Center.
NUCLEAR AND RELATIVISTIC ASTROPHYSICS AND NUCLIDIC COSMOCHEMISTRY: 1963 - 1967, VOLUME 2
Review Report No. 37
B. Kuchowicz 1969 304 p refs
(NEIC-RR-37-Vol-2) Avail: AEC Depository Libraries

A bibliography is given of nuclear and relativistic astrophysics and nuclidic cosmochemistry papers published in 1963, 1964, and 1965. J.M.

N70-38969# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ASTRONOMY FOR THE SEVENTIES
Jun. 1970 27 p refs
Avail: Issuing Activity

The development of a standard earth and an international reference atmosphere is reported. The Lost City meteorite and meteor environment studies are mentioned as well as lunar sample analysis. Stellar atmospheres, a star catalog and atlas, and the use of masers in space are also covered. A telescope design for infrared astronomy and spectral photometry is presented. Plans are discussed for astrophysical research on the earth as a planet, the solar system, and energetic phenomena in the universe. J.M.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-37704# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
FUEL OPTIMAL REORIENTATION OF AXISYMMETRIC SPACECRAFT, MAY 1966 - JANUARY 1970
M. V. Dixon, T. N. Edelbaum (Anal. Mech. Associates, Inc.), J. E. Potter (MIT), and W. E. Vandervelde (MIT) 15 Mar. 1970 26 p refs
(Contract F04701-69-C-0066)

(AD-706386; TR-0066(5306)-15; SAMSO-TR-70-184) Avail: CFSTI CSCL 22/3

The problem of reorienting axisymmetric spacecraft by using reaction control jets and at the same time minimizing fuel expenditure is analyzed. The reorientations considered are not limited to small angle rotations, and axial cross-coupling is not neglected. However, only rest-to-rest maneuvers are studied and the vehicle is modeled as a rigid body free from disturbance torques. It is assumed that the attitude control thrustors can provide large enough torques for the thrust durations to be negligible compared to the maneuver periods. The Pontryagin Maximum Principle is used to determine the optimality of control profiles involving only two thrustor firings - an initial and a terminating thrust. These maneuvers are found to be optimal for a large class of reorientations and this method appears to have great practical potential, typically offering an average spacecraft fuel saving of 10 to 25 percent over current techniques. Author (TAB)

N70-37801# Space Data Corp., Phoenix, Ariz.

DESIGN, DEVELOPMENT AND FLIGHT TEST OF THE VIPER DART ROBIN METEOROLOGICAL ROCKET SYSTEM: DESIGN IMPROVEMENT Final Report, 1 Jul. 1968 - 31 Oct. 1969

Bruce Bollermann and Robert L. Walker 31 Jan. 1970 92 p (Contract F19628-68-C-0393)

(AD-706124; SDC-TM-423; AFCRL-70-0150) Avail: CFSTI CSCL 19/7

The Viper Dart Robin Meteorological Rocket system has been developed to obtain high altitude density and wind data by utilizing the Robin inflatable sphere as a sensing device. The system consists of a rocket motor, an unpowered dart, and the Robin inflatable sphere. Flights of this system provided density, temperature, pressure and wind data from an altitude of about 90 kilometers to an altitude of approximately 40 kilometers or less. An improved rocket motor and C-band radar tracking aid have been developed under this contract. Author (TAB)

N70-37826*# National Aeronautics and Space Administration, Washington, D.C.

SPACE TRANSPORTATION SYSTEM TECHNOLOGY SYMPOSIUM. VOLUME 1: AEROTHERMODYNAMICS AND CONFIGURATIONS

Jul. 1970 575 p refs Symp. held at Cleveland, Ohio, 15-17 Jul. 1970

(NASA-TM-X-52876) Avail: CFSTI CSCL 22B

Selected articles are presented on the aerodynamics and configurations for space shuttle systems, including dynamic stability and control, abort separation procedures, hypervelocity wind tunnel tests of models, flight performance of the booster and orbiter vehicles in the atmosphere, aerodynamic heating, and heat transfer correlations at hypersonic speeds. For individual titles, see N70-37827 through N70-37847.

N70-37827*# National Aeronautics and Space ADministration, Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE BOOSTER AERODYNAMICS: CANARDS, A SOLUTION TO THE BOOSTER CENTER OF GRAVITY PROBLEM

Heinz G. Struck *In its* Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 1-22 refs (See N70-37826 21-31)

Avail: CFSTI CSCL 22B

The canard configuration for the lifting surface of a space shuttle with the center of gravity located in the aft section is considered. The canard concept is shown to offer weight advantages when compared with a wing-fuselage-tail configuration with the center of gravity located at 50 to 60% of the body length. R.B.

N70-37828*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SPACE SHUTTLE AIRBREATHING ENGINE EXHAUST EFFECTS

C. F. Ehrlich, Jr. *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 24-45 (See N70-37826 27-31)

Avail: CFSTI

The changes in vehicle aerodynamic characteristics induced by the exhaust flow from nose-mounted airbreathing engines are evaluated. The tests show that the engine installation arrangement can have a significant effect on vehicle aerodynamic performance. The mass flow rate and vehicle configuration also affect the aerodynamic characteristics of the vehicle. Author

N70-37829*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

TO WHAT EXTENT SHOULD SPACE SHUTTLE STABILITY AND CONTROL BE PROVIDED THROUGH STABILITY AUGMENTATION?

M. E. Wawrzyniak *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 (See N70-37826 21-31)

Avail: CFSTI CSCL 22B

Simulation studies were conducted to determine what vehicle deficiencies can be practically augmented to provide the required handling qualities and automatic control system performance in space shuttle vehicles. The studies show that the longitudinal basic airframe minimum stability requirement is a short period natural frequency equal to or greater than zero. The low crossrange orbiter hypersonic yawing-moment coefficient may be negative so long as a Dutch roll oscillatory mode is maintained, and bank angle control is accomplished through yaw attitude control. A roll damper may be employed, but vehicle roll attitude must not be tightly constrained if 'dynamic' lateral directional stability is to be maintained. The lateral control considerations strongly influence the directional stability required for the high crossrange configurations, and a negative yawing-moment coefficient cannot be justified without a detailed control analysis. Author

N70-37830*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

ABORT SEPARATION INCLUDING AERODYNAMIC DYNAMIC, PROPULSIVE, AND TRAJECTORY INFLUENCES

John P. Decker, Robert J. McGhee, and P. Kenneth Pierpont *In its* Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 67-97 refs (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

The various considerations for safe abort separation are considered, including the aerodynamic interference effects of two stages of a space shuttle vehicle when in close proximity, the propulsive effects with emphasis on plume interference effects as well as using separation thrust to separate the two vehicles, the dynamic and damping derivatives and their influence on the abort separation maneuver, and the trajectory influences, Mach number, and altitude at which the abort takes place. The aerodynamic data were obtained for rigid models only; scale and aeroelastic effects are not included. Author

N70-37831*# National Aeronautical Establishment, Ottawa (Ontario).

POSSIBLE USE OF HALF-MODEL OSCILLATORY TECHNIQUES FOR THE STUDY OF SHUTTLE ABORT SEPARATION DYNAMICS

K. J. Orlik-Rueckemann *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 99-118 refs (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

The use of half models for oscillatory experiments based

on evaluation of selected previous half model results for various configurations is discussed. Examples of possible experimental arrangements for determining the damping-in-pitch derivative during the shuttle separation maneuver are given. The half-model technique is practical for dynamic experiments during which the relative positions of the two stages and their overall incidence have to be varied in a large number of steps. The techniques may also be used to determine the dynamic characteristics in pitch of one of the stages as a function of the amplitude and frequency of the other stage. Author

N70-37833*# Grumman Aerospace Corp., Bethpage, N.Y.
THE APPLICATION OF MIL-F-8785B (ASG) TO THE EVALUATION OF LANDING-APPROACH FLYING QUALITIES OF A LIFTING-BODY-TYPE SHUTTLE VEHICLE
J. Chin *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 127-141 refs (See N70-37826 21-31)
Avail: CFSTI CSCL 22B

Based on comparison studies, a level of pilot rating is estimated. This is compared with pilot ratings from an inflight simulation of the shuttle vehicle using a B-26 variable-stability aircraft. The conclusion, within the comparisons, is that the military specification is applicable for evaluating the landing-approach flying qualities of a lifting-body type vehicle. Author

N70-37835*# Northrop Corp., Hawthorne, Calif.
INTEGRATED LAUNCH REENTRY VEHICLE CONFIGURATION STUDY
J. Stalony-Dobrzanski *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 195-219 (See N70-37826 21-31)
Avail: CFSTI CSCL 22B

The tip tank configuration concept for an integrated launch reentry vehicle is investigated. The basic feature of the configuration is the location of all the engines on the shuttle vehicle which are recovered and reused. The parametric study of optimum design shows that the fewer engines on the shuttle vehicle, the less the system lift-off weight and the more economical the 10-year space transportation program. The single stage to orbit with all the engines on the tip tanks is shown to be more economical than the optimum stage-and-a-half configuration with all the engines on the shuttle vehicle. R.B.

N70-37836*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE ASCENT PHASE ABORT CONSIDERATIONS
Christopher J. Cohan *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 221-255 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

The definitions related to abort during the boost phase of the space shuttle are presented and discussed. The rationale for the current shuttle abort philosophy of intact abort is explained. The types of abort situations and the procedures used in establishing these situations are discussed. The main emphasis is on abort procedures and a summary of the abort related technology problems is included. Author

N70-37837*# Aerospace Corp., El Segundo, Calif.
SUBSONIC CRUISE MODE: AN INTACT ABORT CONCEPT
A. Blanciak, O. Kramer, and J. K. Yakura *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 256-289 (See N70-37826 21-31)
Avail: CFSTI CSCL 22

The subsonic cruise mode for intact abort of reusable two stage earth-to-orbit shuttle systems during the ascent phase was investigated. The subsonic cruise mode is shown to be practical provided that the vehicle is designed for a go-around capability. It serves as a primary abort mode for the case of total thrust loss and as an alternative to the abort-to-orbit mode for partial loss of thrust. R.B.

N70-37838*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE BOOSTER RETURN PERFORMANCE
R. B. Bithell and W. A. Pence, Jr. *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 290-321 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

Booster performance analysis is presented for the entry phase and the subsonic phase, and is directed towards defining the best aerodynamic configuration and propulsion system. The following are the conclusions for the booster entry phase: for a 4.0 g load factor constraint, a flyback range of 311 n mi and the effect of staging conditions on flyback range are established; the natural pitch transition and constant angle of attack entry modes were compared; changes in entry performance due to atmosphere model changes are small; and westerly winds during entry increase booster flyback range. The following conclusions are given for the subsonic phase: all weather landing operation on the 10,000-ft runways may require larger wing areas and/or decelerating devices; and the ferry mission capability is seriously restricted by the 19,000-ft runway length requirement. N.E.N.

N70-37839*# Boeing Co., Seattle, Wash.
PROVIDING SAFE LANDING AT HIGH APPROACH SPEEDS FOR SPACE SHUTTLE
Robert J. Pruin *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 323-336 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

A preliminary study is presented of the feasibility of landing a space shuttle on a 10,000-ft runway. High approach speeds provide performance gain by reduced inert weight. It is concluded that approach speeds exceedir.g 220 knots are possible when landing parachutes and an automatic landing system are used. Two 50-ft diameter parachutes would provide the required drag for a 500,000-lb booster landing weight. It was found the approach speed could be increased to 243 knots by reducing the operational margin associated with touchdown dispersion, and to 264 knots by eliminating the margin for icy runways and worn tires on wet concrete. N.E.N.

N70-37841*# Boeing Co., Seattle, Wash.
INTERFERENCE AND RADIATION BLOCKAGE EFFECTS ON SURFACE TEMPERATURES OF COMPOSITE FLIGHT VEHICLES
Alfred C. Thomas *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 390-417 refs (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

An analysis is presented that exposes a potential critical thermal protection system (TPS) problem for composite flight vehicles (CFV). The problem is caused by flow field interference and radiation blockage in the gap between a combined booster and orbiter vehicle during boost. Data shown here indicate that CFV TPS surface panels in the gap may exceed Rene 41 design limit temperatures of 1600 F for about 60 seconds during boost and at some point in the gap may reach temperatures in excess of 2200 F. This is significant because reusable booster vehicle TPS panels are designed for conditions corresponding to booster flyback (not boost) and do not generally require high temperature capability. Author

N70-37844*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TURBULENT HEATING ON SPACE SHUTTLE ORBITERS DURING REENTRY

H. Harris Hamilton *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 463-484 (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

The results of a study of turbulent reentry heating on the lower surface centerline of two space shuttle orbiter configurations are presented. A delta wing orbiter and a straight wing orbiter were usec. Problems that arise when the flow is turbulent as well as uncertainties that exist in computing turbulent heating are discussed. It is shown that turbulent heating can have a large impact on thermal protection system design both in the choice of the heat shield materials and in the system unit weight. Author

N70-37845*# Aerospace Corp., El Segundo, Calif.

A COMPARISON OF SIMPLE TURBULENT HEATING ESTIMATES AND BOUNDARY LAYER TRANSITION CRITERIA WITH APPLICATION TO LARGE, LIFTING ENTRY VEHICLES.

Blaine P. Pearce *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 485-507 refs (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

Results concerning the heat transfer predictions in fully turbulent flow and the effects of boundary layer transition criteria on the heating predictions for the windward surface of a large, lifting entry vehicle are presented. The discussion is restricted to the range of local Mach number and the ratios of the wall to adiabatic wall enthalpy expected to occur near peak turbulent heating. Predictions for heating rates in turbulent flow are examined along with the appropriate form of Reynolds analogy factor, and are compared with experimental data for heat transfer to a flat surface with uniform boundary layer edge conditions. The effect of boundary layer transition is examined by comparing the predictions from different specifications for the onset of transition. The effects of both the different heat transfer prediction methods and the different transition onset criteria are examined by means of the calculations for peak temperatures on the windward centerline for a flat, delta wing. The results show that the boundary layer edge Mach numbers of interest vary from about 8 down to nearly unity, and the wall to adiabatic wall enthalpy ratio for a radiatively cooled heat shield is of the order of 0.1. Author

N70-37846*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ENTRY MANEUVER/AEROTHERMODYNAMIC INTERACTIONS FOR HIGH CROSS-RANGE CANDIDATE ORBITERS

James P. Arrington *In its* Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 509-530 (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

An analysis of constant attitude and pitch modulated entry modes was conducted for space shuttle orbiters capable of 1500 n mi cross range. Significant reductions in total heat load and peak heating rates with minor decreases in soak times were demonstrated for the pitch modulated entry mode. For the L/D(max) = 2 orbiter, a large increase in stagnation heating rate was avoided by initiating the pitch modulation earlier during entry. The angle of attack mode had very little effect on the maximum radiation equalibrium temperatures. By intiially operating an orbiter as a low cross range vehicle, the stagnation heating rate can be reduced by 25%, the total heat load by 41%, and the soak time by 17%. Except for the stagnation region where the difference was on the order of 300 F, there was also little effect of the lower surface maximum radiation equilibrium temperatures. By initially operating an orbiter as a low cross range vehicle, the stagnation heating rate can be reduced by 25%, the total heat load by 41%, and the soak time by 17%. Except for the stagnation region where the difference was on the order of 300 F, there was also little effect of the lower surface maximum radiation equilibrium temperatures due to the cross range. The basic difference between high and low cross range operations is the weight of the thermal insulation material required. Author

N70-37847*# North American Rockwell Corp., Downey, CAlif.

A MINIMUM HEATING FLIGHT MODE FOR HIGH LATERAL RANGE SPACE SHUTTLE ENTRIES INCLUDING THE EFFECTS OF TRANSITION

Jack D. Moote *In* NASA, Washingon Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 531-546 (See N70-37826 21-31)

Avail: CFSTI CSCL 22C

A flight mode optimization study is presented and the aerothermal evaluation of the final trajectory data relative to the selection of boundary layer transition criteria is discussed. The study shows that a constant heat rate flight mode provides minimum heating for the 1500 n.m. lateral range entry trajectory and high lateral range, minimum heating entry trajectories can be flown with very low aerodyanmic loads. Author

N70-37924* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPACE AND ATMOSPHERIC REENTRY VEHICLE Patent

Alan B. Kehlet, Dennis F. Hasson, and William W. Petynia, inventors (to NASA) Issued 21 May 1963 (filed 13 Apr. 1962) 7 p Cl. 244-1

(NASA-Case-XGS-00260; US-Patent-3,090,580; US-Patent-Appl-SN-187446) Avail: US Patent Office

A lenticular vehicle with foldable aerodynamic control flaps pivotally mounted on the upper convex vehicle surface and capable of operating above and within the earth's atmosphere is described. The control flaps are adapted to form a substantially continuous extension of the upper convex vehicle surface when in folded or retracted position during the launch and orbital stages of a mission, and to be deployed into an operative, extended position upon reentry into the earth's atmosphere. The vehicle also has individually actuated reaction jets, positioned on the upper convex surface, for attitude control while outside the atmosphere. An extendible nose ski is provieed for landing on water. R.B.

N70-37938* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SPACE CAPSULE Patent

Maxime A. Faget, Andre J. Meyer, Jr., Robert G. Chilton, Willard S. Blanchard, Jr., Alan B. Kehlet et al, inventors (to NASA) Issued 11 Jun. 1963 (filed 16 Oct. 1959) 7 p Cl. 244-1

(NASA-Case-XLA-00149; US-Patent-3,093,346; US-Patent-Appl-SN-847023) Avail: US Patent Office

A manned capsule configuration capable of being launched into orbital flight and returned to the surface of the earth is described. The capsule is frustro-conical shaped and is provided with different systems for propulsion, aerodynamic drag, and environmental shielding. R.B.

N70-37981* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REFLECTOR SPACE SATELLITE Patent

Wade E. Lanford, inventor (to NASA) Issued 24 Dec. 1963 (filed 11 Feb. 1960) 4 p Cl. 343-18

(NASA-Case-XLA-00138; US-Patent-3,115,630; US-Patent-Appl-SN-8204) Avail: US Patent Office

A method of compactly packaging a centrifugally expandable lightweight and flexible sheet of material, such as a reflector satellite, is described. The reflector consists of a sheet of aluminum coated plastics such as Mylar one to two mils thick. The packaged reflector is provided with a center substantially planar portion which gradually develops into radial folds or pleats, extending to the periphery and forming sawtooth folds on the periphery. A spring is utilized to eject the packaged reflector, and the spin of the spin stabilized carrier is adequate to open and expand the reflector satellite. N.E.N.

N70-37986* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE-GEOMETRY WINGED REENTRY VEHICLE Patent
William H. Phillips, inventor (to NASA) Issued 17 Sep. 1963 (filed 7 Oct. 1960) 6 p Cl. 244-1
(NASA-Case-XLA-00241; US-Patent-3,104,079; US-Patent-Appl-SN-61329) Avail: US Patent Office

An aerospace vehicle configuration is described which is capable of atmospheric reentry and controlled glide landing at low speeds within a small preselected land area of the earth's surface. The vehicle can be launched into space, accelerated to orbital or higher velocities for spatial operation, and can reenter the earth's atmosphere in an initial high drag attitude with a single fixed surface presented to the relative wind. It has subsequent attitude reorientation capabilities and has control surfaces and auxiliary lifting surfaces deployable after reorientation to improve atmospheric glide and landing capabilities. The vehicle is comprised of a basic delta wing having a substantially flat lower surface, a fuselage provided with a human occupancy compartment, and the control surfaces and auxiliary lifting surfaces pivotally mounted on the upper surface of the wing. Its capabilities of being utilized as a ferry vehicle for resupply and crew relief operations in connection with support of permanently orbiting manned satellites is pointed out. P.A.B.

N70-38010* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LANDING ARRANGEMENT FOR AEROSPACE VEHICLE Patent
John M. Riebe and Vernard E. Lockwood, inventors (to NASA) Issued 4 Feb. 1964 (filed 22 Mar. 1962) 4 p Cl. 244-46 Continuation-in-part of US Patent Appl. SN-26375, Filed 2 May 1960
(NASA-Case-XLA-00805; US-Patent-3,120,361; US-Patent-Appl-SN-181829) Avail: US Patent Office

An aerospace vehicle having a variable planform for a low aspect ratio for high speed flight and a high aspect ratio for low speed takeoff or landing is described. The vehicle consists of an elongated fusalage or hull section with an elliptical cross section and tapering towards the ends. Two rotatable mounts are positioned above and below the longitudinal midpoint of the fuselage, on the longitudinal centerline. The mounts can rotate about a common axis and are equipped with reaction motor pods. The reaction motors may be positioned so that the thrust is parallel or perpendicular to the longitudinal axis of the fuselage, for high or low speed flights respectively. N.E.N.

N70-38380*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN SENSITIVITIES OF MULTISTAGE LAUNCH VEHICLES
Dietrich W. Fellenz 26 Sep. 1969 14 p ref
(NASA-TM-X-53944; MSFC-ASO-IN-1-67) Avail: CFSTI CSCL 22D

The derivation and application of a closed-form expression for design sensitivities applicable to any stage of a multistage launch vehicle are described, to replace the previous practice of generating slopes by re-running vehicle performance several times. The procedure is simple and fast and allows the discussion of several conceptual approaches in a common frame of reference. Author

N70-38502*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LUNAR ORBITER FLIGHT VIBRATION DATA AND COMPARISONS WITH ENVIRONMENTAL SPECIFICATIONS
Sherman A. Clevenson Washington Sep. 1970 69 p refs
(NASA-TN-D-6006; L-6594) Avail: CFSTI CSCL 20K

Detailed flight-measured vibration data obtained during the five successful flights of lunar orbiters are presented and compared with vibration levels specified as flight acceptance requirements. Measured flight vibration data on these flights were lower than those measured on previous flights of the Atlas-Agena launch vehicle; thus the flight acceptance random vibration test levels substantially exceeded the flight measurements. The derivation of the flight requirements is also discussed. Author

N70-38676* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MANNED SPACE STATION Patent
Emanuel Schnitzer, inventor (to NASA) Issued 11 Aug. 1964 (filed 5 Apr. 1961) 12 p Cl. 244-1
(NASA-Case-XLA-00258; US-Patent-3,144,219; US-Patent-Appl-SN-101029) Avail: US Patent Office CSCL 22B

A manned satellite space station structural configuration is described which is capable of being stored in a low volume, high density packaged condition in the payload stage of a launch vehicle. Once in orbit, it is self-erectable into its operating configuration upon actuation of built-in mechanical systems. An expandable human occupancy area is divisible into separate areas each capable of sustaining life independently in the event of air leakage's causing one or more areas to be uninhabitable. Means are provided for automatic repair of punctures causing such air leaks. Artificial gravity may be established in the crew quarters, and integral independently inflatable furnishings for crew use are provided. A plurality of inflatable flexible tubular passageways lead from the torus shaped crew quarters to the life support center. Expandable solar energy collector means interconnected with the life support center are extensible to expose a relatively large area to sunlight. P.A.B.

N70-38721*# Kollsman Instrument Corp., Elmhurst, N.Y.
SPACECRAFT STAR TRACKERS
NASA Jul. 1970 69 p refs Sponsored by NASA
(NASA-SP-8026) Avail: CFSTI CSCL 22B

Design criteria for the development of spacecraft star tracker systems is presented. The scope of the subject matter is limited to that part of the tracking system that collects, scans, and senses the star and electronically derives a measure of star position relative to an optical reference. Analyses are given for the design factors influenced by the requirements of high accuracy, low weight, low power drain, and survival during launch and in the space environment. Emphasis is placed on the development of lightweight and compact optical systems, field scan systems that minimize mechanical friction, and solid state circuitry. A state-of-the-art review of star tracking systems is included. D.L.G.

N70-38790*# National Aeronautics and Space Administration. Langely Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A FIXED-WING MANNED SPACE SHUTTLE CONCEPT AT A MACH NO. OF 6.0

David R. Stone Washington Sep. 1970 28 p refs
(NASA-TM-X-2049; L-7234) Avail: CFSTI CSCL 22B

The longitudinal, directional, and lateral stability and control characteristics of the orbiter stage of a two-stage space shuttle concept were determined. Longitudinal data were obtained at angles of attack from −5 deg to 60 deg, and lateral and directional data were obtained at sideslip angles of 0 deg, −2 deg, and −5 deg over this angle-of-attack range. The tests were conducted at a Mach number of 6.0 and a free-stream Reynolds number of 1.24 × 10 to the 7th power per meter. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-37633# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER CONSIDERATIONS IN A PRESSURE VESSEL BEING CHARGED
John Thomas Lyons, III (M.S. Thesis) Jun. 1969 102 p refs
(AD-706713) Avail: CFSTI CSCL 13/4

Experimental data for the charging of an air receiver is presented and interpreted in detail. The data indicates a substantial departure from the adiabatic behavior. The experimental results are used to evaluate existing closed form expressions for the thermodynamic state of a gas in a receiver. A method for experimentally determining the convective heat transfer coefficient is developed, evaluated and used in conjunction with these expressions. Author (TAB)

N70-37648# Sandia Corp., Albuquerque, N. Mex. Applied Mechanics Div. 1544.
DYNAMIC MEMBRANE STRESSES IN A RING
Don W. Lobitz Apr. 1970 46 p refs Sponsored by AEC
(SC-RR-69-866) Avail: CFSTI

The wave solution derived for membrane stresses in a thin circular ring is extended to accommodate arbitrary asymmetric, time-dependent loading. Both linear elastic and linear Maxwell viscoelastic material models are utilized, and the loading may be provided by surface loads as well as heat addition. A computer program is included to implement the solution. Author

N70-37660# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INDENTATION OF AN ELASTIC LAYER BY AN ARRAY OF PUNCHES MOVING WITH STEADY VELOCITY, NOVEMBER 1968 – MAY 1969
Leon M. Keer (Northwestern Univ.) and Charles Sve 23 Mar. 1970 32 p
(Contract F04701-69-C-0066; Grant AF-AFOSR-100-67)
(AD-706884; TR-0066(5240-30)-9; SAMSO-TR-70-176) Avail: CFSTI CSCL 13/9

A solution is presented for the problem of an elastic layer that is indented by an infinite array of punches moving with a steady velocity below the Rayleigh wave speed. The layer is assumed to be loaded symmetrically about its midplane. The equations of plane elasticity are used to develop dual series equations which are reduced to a single Fredholm integral equation. An asymptotic solution to the integral equation is developed for the case when the ratio of contact length to punch spacing is small, and it is compared with a numerical solution. Numerical calculations for the effective stiffness of the layer and the stresses along the midplane are included. Author (TAB)

N70-37668# Boeing Scientific Research Labs., Seattle, Wash.
STRESS AT NOTCH ROOT OF SHAFTS UNDER AXIALLY SYMMETRIC LOADING
Y. F. Cheng May 1970 16 p refs Presented at the Society for Exptl. Stress Anal., Spring Meeting, Huntsville, Ala., 19 – 22 May 1970
(AD-707259; D1-82-0974) Avail: CFSTI CSCL 13/9

Earlier works utilizing the integrated birefringent patterns in transmitted light are briefly reviewed. The method is extended to show that the maximum axial stress at notch root of shafts under axially symmetric loading could be obtained at ease from one observation in transmitted light at room temperature. Illustrative experiment was performed and the result was compared with Neubers solution. The advantages of this method include, firstly, that no freezing nor slicing is required, and, secondly, that the experimentally obtained stress concentration factor is readily applicable in designs in three-dimension since the effect of Poissons ratio is practically eliminated. Author (TAB)

N70-37683# Aerospace Corp., San Bernardino, Calif.
BUCKLING OF CIRCULAR CYLINDRICAL SHELLS WITH DIFFERENT MODULI IN TENSION AND COMPRESSION
Robert M. Jones 12 Jun. 1970 67 p refs Submitted for publication
(Contract F04701-69-C-0066)
(AD-707513; TR-0066(S5816-70)-1(A); SAMSO-TR-70-55) Avail: CFSTI CSCL 11/4

An exact solution is derived for buckling of circular cylindrical shells with different elastic moduli in tension and compression under arbitrary combinations of axial and lateral pressure. The combinations include those in which one component of pressure causes tension. Classical buckling theory, by which is implied a membrane prebuckled shape, is used for simply supported edge boundary conditions. General results in a form analogous to Batdorfs classical k-Z form are presented for several ratios of tensile to compressive elastic moduli. Differences in tensile and compressive moduli are observed to cause significant differences in the buckling loads. This situation is particularly acute when only a small tensile loading component exists in conjunction with an apparently dominant compressive loading component. For example, if a small axial tensile loading is present in a principally external pressure loading environment, a reduction of 17 percent in the external pressure buckling load from the zero axial load case can occur for a tensile modulus that is half the compressive modulus. The present results are important because current composite materials often have significantly different elastic moduli in tension and compression. Author (TAB)

N70-37802# Advisory Group for Aerospace Research and Development, Paris (France).
MANUAL ON FATIGUE OF STRUCTURES. VOLUME 1: FUNDAMENTAL AND PHYSICAL ASPECTS
William G. Barrois Jun. 1970 295 p refs
(AGARD-MAN-8-70-Vol-1) Avail: CFSTI

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1. STRENGTH OF STRUCTURES AND FATIGUE: GENERAL p 3 – 33 refs (See N70-37803 21-32)
2. PLASTIC STRAIN IN METALS p 37 – 70 refs (See N70-37804 21-32)
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5. PHYSICAL CHANGES AND DAMAGE DURING FATIGUE p 203 – 278 refs (See N70-37807 21-32)

N70-37803# Advisory Group for Aerospace Research and Development, Paris (France).
STRENGTH OF STRUCTURES AND FATIGUE: GENERAL
In its Manual on Fatigue of Struct., Vol. 1 Jun. 1970 p 3-33 refs (See N70-37802 21-32)
Avail: CFSTI

A study intended for design and production engineers in the aircraft industry is presented. The representativeness of fatigue testing, strength of structures concept, and airframe fatigue are reviewed. Further discussion includes the following concepts: fatigue notations; fractures; Wohler S-N curve; stress concentrations, including scale effect and stress gradient, and test results on notched specimens; and the effect of static mean stress and residual stresses. P.A.B.

N70-37804# Advisory Group for Aerospace Research and Development, Paris (France).
PLASTIC STRAIN IN METALS
In its Manual on Fatigue of Struct., Vol. 1 Jun. 1970 p 37-70 refs (See N70-37802 21-32)
Avail: CFSTI

The way in which external loads and heating can change the atomic or molecular arrangement and affect its stability is examined. It is assumed that plastic development in metals before cracking causes a change in the relative plastic stiffnesses of neighboring small regions, even though the average stiffness increases, which results in the transfer of a portion of the external loads to smaller areas likely to break. Topics discussed are: work hardening and recovery, including slip, dislocations, and structural defects, slip planes, lamellae, and slip bands, and the Bauschinger effect; stability of atomic lattice distortions, including energy barriers and deformation bands, diversification of plastic stiffness on slip planes, the Cottrell effect, and residual stresses and strains; hot recovery and recrystallization; deformation and metallurgical transformations, including precipitation, aging, structural hardening, and martensitic transformation; and common features and differences in static and fatigue failures. P.A.B.

N70-37805# Advisory Group for Aerospace Research and Development, Paris (France).
STATIC TESTS OF SPECIMENS: CREEP
In its Manual on Fatigue of Struct., Vol. 1 Jun. 1970 p 73-126 refs (See N70-37802 21-32)
Avail: CFSTI

Tensile tests are discussed with relation to the effect of the test rate on the stress-strain curve, the effect of temperature, the pre-straining effect, hardness, notch impact strength, and notch effect. The aspects of plastic deformation common to both static testing and creep are examined, and the apparent differences due to the time and temperature ranges are considered. Straining in crystals, a description of creep, graphic representations and mathematical approximations of creep, creep life, the effect of pre-strain, and intermittent creep are discussed. Simultaneous stresses and yielding are considered, including simplified assumptions of plastic yielding theories and invariants of the states of stress and strain. Buckling during or after fatigue and creep is examined, with reference to eccentric buckling in the plastic range, changes in compressive stress-strain curves under the effect of hot soaking, creep, or fatigue, and hot static and creep properties. P.A.B.

N70-37806# Advisory Group for Aerospace Research and Development, Paris (France).
STATIC STRENGTH OF NOTCHED OR CRACKED COMPONENTS
In its Manual on Fatigue of Struct., Vol. 1 Jun. 1970 p 129-200 refs (See N70-37802 21-32)
Avail: CFSTI

The static strength of components containing various machined notches is examined, and a general survey of the problem associated with the static strength of cracked specimens is presented. Stress distribution in an infinite thin sheet having a transverse elliptic hole is considered with relation to the limiting case of the slot; a thin sheet of finite width having a transverse central slot is also discussed, along with plasticity correction. The initiation and growth of cracks are considered, including fracture modes on a submicroscopic scale, the stability concept, experimental measurement of the elastic energy released under deflection for a unit increase of the fractured area, the behavior of cracked plates in fatigue and static failure, and the effect of the sheet thickness. Solutions suggested by the theory of elasticity are examined for such problems as crack-tip stress field, crack at the edge of a circular hole, edge cracks in plates, and internal and surface cracks. Methods of prediction of the residual static strength of cracked components are discussed; physical methods applicable to thin sheet materials are analyzed. Test data are included. P.A.B.

N70-37807# Advisory Group for Aerospace Research and Development, Paris (France).
PHYSICAL CHANGES AND DAMAGE DURING FATIGUE
In its Manual on Fatigue of Struct., Vol. 1 Jun. 1970 p 203-278 refs (See N70-37802 21-32)
Avail: CFSTI

The plastic process prior to the appearance of visible cracks is discussed with relation to adjustments and creep during fatigue; fatigue curves under constant amplitude strain loading; changes in stiffness and in damping during fatigue; changes in the magnetic quantities; electrical resistivity changes with plastic strain, annealing, and fatigue; fatigue gauges, and fatigue monitors. Fatigue crack propagation is considered, including the physical process; relative duration of crack initiation and crack propagation stages; crack growth rate; mean stress effect; frequency, temperature, and humidity effects; heat treatment effect; variations with the batch, the manufacturer, and the rolling direction; effect of load sequences; and the measurement and evaluation of the stress intensity factor in thin sheet structures. Facts concerning the average qualitative laws governing the behavior of materials and structures in fatigue are reviewed. The effect of stress gradient, damaging and improving changes during the fatigue process, and the improving effect of overloads on crack propagation are included in the survey. P.A.B.

N70-37922 University of Southern Calif., Los Angeles.
PROPAGATION OF PLANE WAVES IN THERMOELASTO-PLASTIC MEDIA
Gerald Arthur Gurtman (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-19371

An attempt is made to incorporate the effects of finite deformation and thermomechanical coupling on the propagation of a plane, one dimensional elasto-plastic wave in adiabatic materials. A form of the free energy function is hypothesized, which leads to specific constitutive and energy equations. The system of equations is first specialized to the case of a plane longitudinal wave propagating in a half space. The finiteness of the deformations is preserved, and the original system of equations is modified to utilize the method of characteristics. The characteristics and compatibility relations are obtained, and their implications discussed in detail. Jump conditions at the wave fronts are developed for the case of shock formation. A mixed computational scheme using both characteristic relations and straightforward finite difference forms of the original equations is programmed for the case of infinitesimal shear deformations. A numerical solution is generated, and trends are noted. Dissert. Abstr.

N70-37935# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
VEHICLE STRUCTURAL RESPONSE: DYNAMIC ANALYSIS OF AUTOMOTIVE STRUCTURAL SYSTEMS
L. Selna and D. Salinas *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 423-445 refs (See N70-37926 21-34)
Avail: Issuing Activity

A three-dimensional finite element elasto-dynamic math model has been developed for study of vehicle structures during crash episodes. The response of a vehicle to a frontal barrier collision is studied with the model. The results of this simulation evince the dynamic behavior of the vehicle. These results also demonstrate the need for generalization of the model to include effects of geometry change and material nonlinearity. Author

N70-37937# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
DYNAMIC PHOTOELASTIC STUDIES
L. P. Felton *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 469-486 refs (See N70-37926 21-34)
Avail: Issuing Activity

Photoelastic techniques described are used in the analysis of biochmechanical and structural problems associated with mechanical impact on two dimensional models of the human head in simulated automobile collisions. The quantitative stress analysis of observed photoelastic data considers oblique-incidence patterns in evaluating dynamic response of the head model. G.G

N70-37954 Pittsburgh Univ., Pa.
INVESTIGATION OF SUBCRITICAL CRACK PROPAGATION
John M. Barsom (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-18378

A technique was developed to accurately measure incremental fatigue-crack growth and corrosion-fatigue crack growth by following the extension of the crack along uniformly spaced marks on the surface of a wedge-opening-loading (WOL) specimen that was cycled between constant minimum load and constant maximum load. The primary factor affecting subcritical crack growth in fatigue at low stress intensity levels was found to be the applied strain energy release rate per unit crack extension. Hence it was concluded that subcritical crack growth was governed by the yield strength of the material, and the crack-opening dislocation. Furthermore, it was suggested that hydrogen embrittlement enhances the corrosion-fatigue crack growth of high strength steels by decreasing the ductility of the material. Dissert. Abstr.

N70-37963# California Univ., Berkeley.
THERMODYNAMICS OF A CONTINUUM WITH INTERNAL CONTRAINTS
A. E. Green, P. M. Naghdi, and J. A. Trapp 1969 37 p refs (Contract N00014-69-A-0200-1008)
(AD-706304) Avail: CFSTI CSCL 20/11

Three alternative procedures for studying the effect of thermo-mechanical constraints on the response of materials are discussed, employing concepts which are significantly different from those of the purely mechanical theory of constraints. Each of the three procedures has a different starting point and is based on somewhat different assumptions but, all three lead to the same final conclusions. Although these developments are carried out for non-polar media, any one of the three procedures can be adopted for generalized materials. This is illustrated for a constrained liquid crystal. Author (TAB)

N70-37966# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ASYMPTOTIC SOLUTION OF A THICK SPHERICAL SHELL WITH CIRCULAR HOLES
Howard N. Franklin and Jerome M. Klosner Apr. 1970 78 p refs
(Contract Nonr-839(40))
(AD-706748; PIBAL-70-15) Avail: CFSTI CSCL 20/11

A singular perturbation analysis is developed for a spherical shell, containing two diametrically opposite holes, subjected to an axisymmetric external pressure. The asymptotic formulation decomposes the shell into three subregions, an interior region, a wide boundary layer, and a narrow boundary layer. The subregional solutions are matched and a uniformly valid solution is obtained. Stress concentration factors, radial normal and shearing stresses, and displacements are presented for a hole subtended by a half angle of one-tenth of a radian. It is shown that the narrow boundary layer region is of the order of the shell thickness, while the wide boundary layer effects may be neglected at distances greater than twice the square root of Rh from the hole. Author (TAB)

N70-37967# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
PROPAGATION OF HARMONIC WAVES IN ORTHOTROPIC CIRCULAR CYLINDRICAL SHELLS. PART 1: THEORETICAL INVESTIGATION
Edward S. Reitz and Anthony E. Armenakas Mar. 1970 31 p refs
(Contract Nonr-839(40))
(AD-706749; PIBAL-70-18) Avail: CFSTI CSCL 20/11

In this investigation the general frequency equation for trains of harmonic waves having an arbitrary number of circumferential nodes, traveling in orthotropic circular cylindrical shells is established on the basis of the three-dimensional linear theory of elasticity, by expanding the displacement components in power series of the radial coordinate. Simpler forms of the frequency equation for axisymmetric nontorsional and torsional motion and for longitudinal-shear and plane strain motion are established and discussed. Author (TAB)

N70-38016# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NECKING IN A BAR
Winston H. Chen Mar. 1970 66 p refs
(Contract ARPA SD-88)
(AD-706364; ARPA-TR-40) Avail: CFSTI CSCL 20/11

The necking process of an axisymmetric tension specimen made of elastic-plastic, strain-hardening material is analyzed by a generalized J sub 2-flow theory for large deformations. The governing equations are solved in a Kantorovich type approach based on a variational principle. The effects of both geometric nonlinearities resulting from large deformations and the physical nonlinearities arising from plastic material behavior are considered. Numerical results have been found for the stress and deformation histories in the specimen up to a 50% reduction of the neck radius. The shape of the neck, for the first time, is rationally calculated. Author (TAB)

N70-38017# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
POLAR MEDIA: THE CLASSICAL AND RELATIVISTIC THEORY
Charles B. Kafadar and A. Cemal Eringen Jan. 1970 106 p refs
(Contract N00014-67-A-0151-0004)
(AD-706363; TR-11) Avail: CFSTI CSCL 20/11

The theory of continuous deformable polar media is presented in two parts, the classical theory and the relativistic theory. For both cases, the kinematics, balance laws and constitutive theory are

examined and used to develop an elasticity determined through a function basis. Several fundamental problems dealing with the nonrelativistic elasticity are solved. Author (TAB)

N70-38048# Brown Univ., Providence, R.I. Div. of Engineering.
A NOTE ON THE SMALL STRAIN FORMULATION FOR ELASTIC-PLASTIC PROBLEMS
James R. Rice Apr. 1970 17 p refs
(Contract N00014-67-A-0191-0003)
(AD-706769; TR-8) Avail: CFSTI CSCL 13/13

Many ductile metals, particularly the higher strength structural alloys, exhibit a stress-strain curve having a slope in the plastic range which is of the same order of magnitude as the flow stress. This may occur even at strains which are quite small compared to unity. It is pointed out that this situation raises questions as to the validity of the conventional small strain formulation of elastic-plastic problems. The small strain formulation is re-examined here and derived as a limiting case of a finite strain formulation. The difficulties encountered are similar to those in the superposition of small elastic deformations on large deformations. The conventional small strain formulation neglects terms of the same order of magnitude as those it retains when the hardening rate and stresses are of comparable order. Among the results, it is seen that for this case the conventional elastic-perfectly plastic small strain formulation emerges as an approximation of consistent order to the finite strain formulation. Author (TAB)

N70-38054# Naval Postgraduate School, Monterey, Calif.
SYNTHESIS OF DOUBLY SYMMETRIC VIBRATING BEAMS INCLUDING SHEAR
Thomas Daniel Pestorius (M.S. Thesis) Jun. 1969 32 p refs
(AD-706730) Avail: CFSTI CSCL 13/13

A fundamental, non-linear, ordinary differential equation is derived for the flexural vibrations of a non-uniform beam, including shear. This equation is solved with the specializing assumptions of a constant shear coefficient and that the moment of inertia is directly proportional to the cross sectional area. A perturbation method is used and the eigen frequencies and mode shapes obtained are functions of a perturbation parameter epsilon. These solutions are accurate up to the second order of epsilon. Author (TAB)

N70-38077# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
FRACTURE TOUGHNESS OF STRUCTURAL METALS
Interim Report
E. A. Lange 4 May 1970 29 p refs
(AD-707338; NRL-7046) Avail: CFSTI CSCL 11/6

On the basis of the information presented in the report, the following conclusions are stated concerning the status of the engineering approach to fracture-safe design using fracture-toughness values as performance criteria. (1) The coupling between engineering fracture tests (C sub v and DT) for measurement of fracture resistance and linear-elastic fracture mechanics theory has been achieved. (2) Interpretive diagram systems (FAD and RAD) have been developed which couple the fracture toughness values from engineering fracture tests to the analytical capability of fracture mechanics. (3) The DT test has the capability for measuring a broad range of fracture toughness extending from the low energy region pertaining to elastic fractures to the high-energy region pertaining to fully plastic fracture. (4) Difficulties in the interpretation of C sub v energy values within the transition region (plane strain to plane stress) for high-strength steels and nonferrous structural alloys may limit the use of C sub v energy as a performance criteria for certain materials. Author (TAB)

N70-38086# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
ON A THEORY OF SHELLS
T. R. Steel Jan. 1970 24 p refs
(Contract N00014-67-A-0370-0001)
(AD-706782; CAM-100-11) Avail: CFSTI CSCL 20/11

A technique is given for reducing the three-dimensional continuum theory to a two-dimensional shell theory, which allows a great deal of freedom in choosing the most appropriate form of shell theory for a particular problem. The two-dimensional equations obtained can be identified with director theories of shells by suitably interpreting the directors. An example is given using a particular form of the technique which shows that the shell equations reduce to the classical membrane equations as the thickness of the shell tends to zero, assuming only that the transverse normal stress across the thin shell is small compared to the other normal stresses. Author (TAB)

N70-38097# South Dakota State Univ., Brookings. Dept. of Mechanical Engineering.
SIMILARITY BETWEEN CREEP RUPTURE IN VISCOELASTIC SOLIDS AND FATIGUE IN METALS
Michael P. Wnuk Apr. 1970 78 p refs
(Contract N00014-70-0C-0077)
(AD-707100; TR-1; SDSU-70-1) Avail: CFSTI CSCL 20/11

A local energy criterion of Irwins type is applied to a problem of a quasi static extension of a crack embedded in an elastic-plastic or visco-elastic-plastic matrix. The creep rupture under sustained loads and fatigue crack propagation, both described by the above equation, are shown to follow almost identical mathematical representations. The essential features such as the universal resistance curves, the dependence of growth rate on the current K-factor and te amount of growth vs. time relations are shown to be strikingly similar. Author (TAB)

N70-38102# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
ON THE OPTIMAL STRUCTURAL DESIGN FOR A NONCONSERVATIVE ELASTIC STABILITY PROBLEM
Raymond H. Plaut 1970 18 p refs
(Contract N00014-67-A-0191-0009)
(AD-706786) Avail: CFSTI CSCL 13/13

The design of a cantilever column under a follower load is considered with the aim of maximizing the critical value of the load. The optimality condition is derived and a modified Ritz method is used to determine an approximate solution for the bending stiffness. Results are obtained numerically for the case of a sandwich column with constant bending stiffness in each of two segments. It is found that, for the same structural weight, the optimal design yields a critical load significantly higher than that for a uniform column. Author (TAB)

N70-38124# Toronto Univ. (Ontario). Inst. for Aerospace Research.
MATERIALS SCIENCE AND STRUCTURES
In its [Inst. for Aerospace Res.] Nov. 1969 p 64-79 refs
(See N70-38116 21-01)
Avail: CFSTI

The structural mechanics program was expanded to include a study of bonded honeycomb curved panels and thermal flutter of long flexible booms used in satellite applications, and efforts to determine the effect of shape imperfections on the buckling behavior of cylinders has continued. The shell research concerned with uniform axisymmetric distributions of imperfections was completed. Work has been directed towards analyzing random axisymmetric imperfection profiles using power spectral density techniques. The

scope has been broadened to include buckling studies of perfect and imperfect oval impact cylinders, and dynamic impact testing of thin walled cylinders. Author

N70-38143# National Materials Advisory Board, Washington, D.C.
MASSIVE GLASS AS A NAVAL STRUCTURAL MATERIAL
Final Report
Apr. 1970 108 p refs
(Contract DA-49-083-OAS-3131)
(AD-706223; NMAB-262) Avail: CFSTI CSCL 13/10.1

Massive glass has potential as a structural material for a variety of high efficiency, deep ocean applications. However, neither the existing data on massive glass nor current industrial production capability are adequate for the task. This is especially true in producing a man-rated glass pressure hull by a target date of 1980. The application of glass as a structural material for deep submergence was reviewed and evaluated in the report. Specific areas of glass technology requiring research, development, testing and evaluation effort are described. A structural design scale-up program using models and full-size pressure hulls is suggested. Concurrent materials studies, design evaluation programs, and production development are recommended. Author (TAB)

N70-38165# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
ANALYSIS OF CONTACT PROBLEMS BY MEANS OF AN OPTIMIZATION TECHNIQUE
Kyung E. Yoon (Ph.D. Thesis) Jun. 1970 109 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-707448; THEMIS-UI-24) Avail: CFSTI CSCL 13/13

In this report an approximate but general method of solving certain contact problems is developed by utilizing an optimization technique. It is shown that the problems of unbonded contact between two elastic bodies may be posed as optimization problems in the following sense: Determine the contact stress distribution which minimizes the difference between two boundary deflections by the contacting bodies, subject to some constraint conditions. Furthermore, this optimization problem can be reduced through discretization to a linear programming problem. Author (TAB)

N70-38169*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DERIVATION OF TWELVE-BY-TWELVE STIFFNESS MATRIX FOR SHEAR PANEL UNDERGOING PARABOLIC DEFORMATION
Gary Muller 12 Sep. 1969 54 p refs
(NASA-TM-X-53902; MSFC-IN-3-67) Avail: CFSTI CSCL 20K

Equations are derived for finding the stiffness matrix for a twelve-node shear panel. The deflections of a hypothetical cantilever beam composed fo five twelve-node shear panels are then compared with those of six other equivalent cantilever beams. Two are classical strength of materials beams, one excluding shear effects, and the other including shear effects. The third is a theory of elasticity beam. The last three beams are composed of eight-node linear deformation shear panels, one composed of one row of five panels, the second composed of two rows of five panels per row, and the third composed of three rows of five panels per row. Tip deflection of the five twelve-node shear panels beam is 93 percent of the strength of materials beam excluding shear, whereas that of the best eight-node beam is 73 percent. Author

N70-38185# ARA, Inc., West Covina, Calif.
RESEARCH ON ENERGY ABSORBING STRUCTURES, PART 8 Annual Report, 1 Feb. 1969 – 1 Feb. 1970
Bernard Mazelsky, T. H. Lin, and Sheng-Rong Lin Mar. 1970 40 p refs
(Contract F44620-68-C-0041)
(AD-706417; ARA-109-Pt-8; AFOSR-70-0730TR-Pt-8) Avail: CFSTI CSCL 13/13

The increase of axial strain with number of cycles of torsional loading is similar to the increase of creep strain with time. The slope of isochronous curves for creep is commonly used to estimate the creep buckling of columns. Consequently, the slope of stress-strain curves at different torsional cycles, called effective modulus, may similarly estimate the buckling of columns subject to cyclic torsional loading. Tests were conducted to obtain the effective modulus of thin-walled tubular specimens of aluminum alloy 2024-T351 with axial tension and cyclic torsion. A method for calculating large deflections of elasto-plastic shells of revolution under axisymmetric loadings is presented. The problem involves two types of non-linearity; one is geometrical due to finite strain and the other is due to non-linear stress-strain relations. Author (TAB)

N70-38194# California Univ., Berkeley. Operations Research Center.
TWO-DIMENSIONAL NETWORKS
Anna Borreani Feb. 1970 35 p refs
(Contracts N00014-69-A-0200-1010; DA-31-124-ARO-D-331; Grant NSF GP-15473)
(AD-704080; ORC-70-6) Avail: CFSTI CSCL 12/2

A two-dimensional flow network is defined for a planar pinned truss with concentrated external loads acting under statically determinate equilibrium. Analogies between this two-dimensional network and the usual flow network are explored by defining two-demand notions of flows, paths, and cuts. It is shown that a flow has a path-flow decomposition, under certain restrictions, and that a duality between paths and cuts exists. Finally, the notion of a two-dimensional cut is related to the notion of a generalized cut in matroid theory, introduced by Fulkerson. Author (TAB)

N70-38231# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTEGRAL METHODS IN DYNAMICS
A. N. Golubentsev 13 Mar. 1970 268 p refs Transl. into ENGLISH from the publ. 'Integrainyye Metody v Dinamike' Moscow, Nauka Press, 1967 p 1–350
(AD-706774; FTD-HT-23-145-69) Avail: CFSTI CSCL 20/11

New methods (based on the application of integral equations) of investigating the dynamics of systems are proposed. Complicated problems in machine dynamics are solved by means of these methods, and special attention is paid to the analysis of dynamics phenomena in machinery. The analysis of the transient processes here discussed includes the construction of diagrams, i.e., the obtaining of numerical results, and is illustrated by detailed sample solutions. Special transient-process functions are set up, and their values for various magnitudes of the argument and parameters are given in tables. Problems in the theory of systems optimal with respect to damping are examined, and aperiodicity criterial of vibrational processes are given which can be used in designing automatic-control systems. The dynamic minimax problem (selection of a system parameters such that the maximum coordinate deviation attains its minimum value) is solved by numerical methods; the integral methods used make it possible to obtain relatively simple solutions. The proposed methods can be applied to automatic-control problems in determining the optimum parameters of a system with the lowest sensitivity to vibration; these methods give satisfactory results in solving the majority of optimum problems in dynamics of transient processes in modern machinery. Author (TAB)

N70-38294*# Hughes Aircraft Co., Culver City, Calif.
LANDING IMPACT ATTENUATION FOR NON-SURFACE-PLANING LANDERS

R. H. Jones NASA Apr. 1970 47 p refs Sponsored by NASA
(NASA-SP-8046) Avail: CFSTI CSCL 20K

Research is reported, concerned with the design of lander attenuation systems and with the analytical and experimental assessment of touchdown dynamics from the moment of surface contact until the lander comes to rest. Criteria and recommended practices are presented for attenuator design and for determination of landing decelerations, loads, and stability as needed to ensure structural integrity and acceptability of performance. All landers, except those whose primary landing mode consists of surface planing after impact, are considered. Author

N70-38326# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
DISPERSION OF AXIALLY SYMMETRIC WAVES IN THREE-LAYERED ELASTIC SHELLS
Henry E. Keck and Anthony E. Armenakas Feb. 1970 38 p refs
(Contract F44620-69-C-0072)
(AD-706136; PIBAL-70-8; AFOSR-70-0529TR) Avail: CFSTI CSCL 13/13

The frequency equation for trains of axisymmetric harmonic waves traveling in infinitely long, three-layered circular cylindrical shells and rods is established on the basis of the three-dimensional theory of elasticity. The shell or rod is assumed to be made of three concentric cylinders each of different isotropic material, bonded perfectly at their interfaces. The frequency equation has been evaluated numerically and the effect of the geometric and physical parameters of three layered shells on the frequency of the first few modes is illustrated. The limits that the phase velocities of the various modes of propagation approach asymptotically at large wave numbers are established analytically and verified by the numerical results. Author (TAB)

N70-38348# Technische Hogeschool, Delft (Netherlands).
PERMISSIBLE STRESSES AND THEIR LIMITATIONS
J. J. W. Nibbering Washington Ship Struct. Comm. 1970 18 p refs
(SSC-206) Avail: Issuing Activity

Various aspects of capability and demand of ships such as extreme loads, cyclic loads, plastic design, crack design, collapse and damage are discussed in an attempt to make a synthesis. It is explained that whenever permissible stresses are used in structural design, they should be bounded by probability-concepts, deformation criteria and critical crack lengths. For an acceptable risk factor, the margin between capability and demand seems to be substantial in ships. Drastic reductions in structural weight are possible if the principle of "fail safe" design is adopted in shipbuilding to the same extent as in aircraft building. Author

N70-38388# Brown Univ., Providence, R.I. Div. of Engineering.
DYNAMIC PLASTIC DEFORMATION OF METAL UNDER COMBINED STRESS STATES Final Report, 1 Dec. 1968 - 28 Feb. 1970
J. Duffey and R. J. Clifton 28 Feb. 1970 6 p ref
(Contract DAHC04-69-C-0027)
(AD-706894; AROD-7598-2-E) Avail: CFSTI CSCL 20/11

The objectives of the investigation was to obtain experimental information which would contribute to the understanding of the mechanisms involved in the dynamic plastic behavior of metals and which would aid in the development of constitutive equations applicable for plastic deformation at high rates of strain. The experimental program involved two essentially different, yet complementary, types, of tests. In the first type of test a short tubular specimen was subjected to dynamic loading in combined tension and torsion for a period of time that was very long relative to the time required for stress wave propagation in the specimen. The objective of such a test was to obtain a dynamic stress-strain curve for straining along an essentially radial path in strain space. In the second type of test a long tubular specimen, initially pre-stressed in torsion, was subjected to a longitudinal impact. Because each of the plastic strain components (longitudinal and torsional) depends on both the normal stress and the shear stress, coupling between the longitudinal motion and the torsional motion occurs. As a result, combined longitudinal and torsional plastic waves are propagated. Study of this type of wave propagation provides insight into the form of the constitutive equations for dynamic plastic deformation under combined stress. Author (TAB)

N70-38405# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF TOROIDAL SHELLS
I. A. Birgera et al 23 Mar. 1970 46 p refs Transl. into ENGLISH from Prochnost Ustoychivost Kolebaniya (USSR), v. 1, 1968 p 776 - 812
(AD-706799; FTD-MT-24-31-70) Avail: CFSTI CSCL 20/11

A discussion is given of thin toroidal shells with circular cross-section of constant thickness, being under the action of smooth axisymmetric and reverse-symmetric external loads and temperatures. Calculation of toroidal shells, axisymmetric bending, axisymmetric torsion, reverse-symmetric case and examples of calculation are discussed. Author (TAB)

N70-38469 Kansas State Univ., Manhattan.
THERMAL STRESSES IN A FINITE CIRCULAR CYLINDER
Albert Chang-Chih Yen (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-21150

A solution to the quasi-static thermoelasticity problems of a finite circular cylinder is presented. The temperature field was assumed to be symmetrical about the longitudinal axis of the cylinder. The thermoelastic displacement potential is used for the particular solution of the governing differential equations. The Love function is used for the homogeneous solution. These functions were so constructed that the boundary conditions may be satisfied on all the boundary surfaces. The solution is formulated for a hollow cylinder and reduces to that for a solid cylinder as the inner radius of the cylinder approaches zero. While there was previous work done on the problem, that work is either approximate or more restrictive in application than the one presented here. In general, if the solution of the equation of heat conduction is obtainable and admits the Bessel - Fourier series expansion, the procedure demonstrated may be applied to solve the corresponding thermoelasticity problem. Dissert. Abstr.

N70-38484# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Muelheim (West Germany).
THEORETICAL INVESTIGATION OF THE THREE-DIMENSIONAL STRESS DISTRIBUTION IN RADIAL FLOW COMPRESSOR WHEELS [THEORETISCHE ERMITTLUNG DER DREIDIMENSIONALEN SPANNUNGSVERTEILUNG IN RADIALVERDICHTERRAEDERN]
Ralf Cuntze May 1970 75 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-70-16) Avail: CFSTI; ZLDI Munich: 19.90 DM

The stress-distribution in a rotating, thermally loaded anisotropic disc with radial blades was examined. The problem was divided into three parts: (a) inplane loading of the blade, (b) symmetrical rotational loading of the disc, and (c) circumferential harmonic loading of the disc due to the blades. The method of finite elements was used and an iterative solution of the combined problem was carried out in which the displacements of the disc were used as boundary conditions for the blade, and the nodal point

forces at the junction of the blade and the disc were used as boundary conditions for the disc. The results are compared with closed form solutions where possible. Author (ESRO)

N70-38513# Brown Univ., Providence, R.I. Center for Dynamical Systems.

DISPLACEMENT BOUNDS FOR BEAM-COLUMNS WITH INITIAL CURVATURE SUBJECTED TO DYNAMIC LOADS

R. H. Plaut [1970] 16 p refs

(Contract N00014-67-A-0191-009)

(AD-707435) Avail: CFSTI CSCL 13/13

Elastic beam-columns with initial curvature and pinned or clamped ends are considered. An upper bound on the lateral displacement response to axial and distributed lateral loads is derived by means of an energy-type functional and some inequalities. The result is significant because of its generality. Author (TAB)

N70-38535# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

KINETICS OF CRACK DEVELOPMENT IN VISCOUS-ELASTIC MATERIALS

A. O. Kaminskii 27 Feb. 1970 10 p refs Transl. into ENGLISH from Dopovidi, Akad. Nauk URSR, Ser. A Fiz. Tekhn. Ta Mat. Nauki (Kiev), v. 30, no. 9, 1968 p 856–860

(AD-706797; FTD-HT-23-328-69) Avail: CFSTI CSCL 20/12

An equation describing the steady advancement of the crack ends in a viscoelastic solid is derived, and analytical formulas for determining the propagation of crack points in an infinite viscoelastic strip are discussed as an example. TAB

N70-38569*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY DESIGN PROCEDURE FOR END RINGS OF ISOTROPIC CONICAL SHELLS LOADED BY EXTERNAL PRESSURE

Sidney C. Dixon and John B. Carine Washington Sep. 1970 35 p refs

(NASA-TN-D-5980; L-6777) Avail: CFSTI CSCL 20K

The effect of ring size on the buckling of truncated isotropic conical shells supported at the ends by rings and subjected to hydrostatic- or lateral-pressure loadings were studied. Results were obtained from an approximate theory based on Donnell-type shell theory and a membrane-prestress state. For a given shell geometry, the ring properties were varied to determine the smallest ring required to provide the equivalent of essentially clamped support. For a particular application, this procedure yielded the minimum mass of the shell-ring configuration. A nondimensional stiffness parameter was determined which correlated the results for the entire range of ring and shell geometries considered. Approximate formulas are presented for the preliminary design of rings with both closed (circular and square) and open (I and Z) cross sections. Author

N70-38583# Eidgenossische Technische Hochschule, Zurich (Switzerland).

THE CALCULATION OF ELASTIC STRESS DISTRIBUTION IN ROTATING DISKS WITH ARBITRARY TEMPERATURE DEPENDENT MATERIAL PROPERTIES [DIE BERECHNUNG DER ELASTISCHEN SPANNUNGSVERTEILUNG IN ROTIERENDEN SCHEIBEN BEI BELIEBIG TEMPERATURABHAENGIGEN WERKSTOFFEIGENSCHAFTEN]

Viktor Beglinger (Ph.D. Thesis) 1969 108 p refs In GERMAN

(DISS-4249) Avail: CFSTI

Developed are the differential equations for stress distribution in a rotating disk of arbitrary thickness, temperature, and material properties. By numerical integration obtained dimensionless solutions for differential equations are depicted in tables and diagrams for the case of a conical disk where temperature, elastic modulus, and thermal elongation vary linear with the radius. Also developed is a computer program that determines elastic stress for an ordinary sample at arbitrary boundary conditions by numerical integration. The disk properties are introduced point by point at variable intervals so that linear interpolation takes place between two points. Transl. by G.G.

N70-38609# Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE PHASE 2, Progress Report, Jan.–Mar. 1970

Robert J. Eiber, Willard A. Maxey, Arthur R. Duffy, and Thomas J. Atterbury Apr. 1970 6 p

(Contract W-7405-eng-92)

(BMI-1880) Avail: CFSTI

Activities in a program to gain information on flaw sizes required to initiate pipe fractures are discussed. Data are also being obtained on the area-opening rate as a function of time and on the extent of fracture. Details of an experiment in which a pipe system is ruptured with subsequent measurements of blowdown behavior are included. NSA

N70-38627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRESS CONDITION OF AN OPEN THIN WALLED MEMBER, WHICH IS MADE UP OF PLATES AND COVERS

N. P. Fleishman et al 27 Feb. 1970 18 p refs Transl. into ENGLISH from Visnyk Lvov Univ., Seriya Mekhaniko-Matematychna (USSR), no. 1, 1965 p 76–88

(AD-706654; FTD-HT-23-323-69) Avail: CFSTI CSCL 13/13

A solution is given to the problem of bending of a thin walled structure made of three strips and two quarter circle cylindrical shells of infinite length. For arbitrary loads, the stress strain state of the structure is described by general linear equations of the thin plate bending theory, the plane problem of the elasticity theory, and the engineering theory of shells. The boundary conditions at the lines of junction between the plates and shells are used for the determination of constants entering into the general solutions of the respective equations. The development of the theory is complemented by a list of values of certain auxiliary functions. The theory is applied to the cases of C and shaped structures. The solutions may be used for the study of stresses in longerons of mobile freight elevators and other load carrying elements. Author (TAB)

N70-38632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRENGTH, STABILITY, OSCILLATIONS, CHAPTER 3

I. A. Birgera et al 15 Apr. 1970 32 p refs Transl. into ENGLISH from the Russian

(AD-706644; FTD-MT-24-32-70) Avail: CFSTI CSCL 13/13

The report is a translation of the Third Chapter, of the Third Volume of Prochnost, Ustoychivost, Kolebaniya, a handbook in three volumes. It deals with stability of shells, particularly within the limits of elasticity. TAB

N70-38643# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.

SHOCK ANALYSIS OF STRUCTURAL SYSTEMS Interim Report, Mar. 1969–Feb. 1970

Vernon H. Neubert, V. P. Rangaiah, and W. H. Vogel Feb. 1970 161 p refs

(Contract Nonr-656(28))

(AD-707055; IR-9) Avail: CFSTI CSCL 13/13

Three separate reports are included. The first presents lumped-parameters Bernoulli-Euler beam models or finite elements which are derived based on mechanical impedance at the ends of the element. Possibility of developing higher frequency models using three parameters is emphasized. The second report presents the stiffness matrix for a visco-plastic beam segment based on a particular constitutive relationship. The significance of the terms in the relationship is demonstrated using a simple example. The third report includes comparison of experimental and theoretical moments and curvatures of a structure consisting of three parallel cantilever steel beams, which were tested in a drop table shock machine. Adequacy of a constitutive relationship for visco-plastic behavior is investigated by comparing predicted and measured moments, curvatures, and curvature rates. Author (TAB)

N70-38674 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF CASTING CONDITIONS AND PROCESS TECHNOLOGY ON AS-CAST STRUCTURE OF CONTINUOUSLY CAST ALUMINIUM [BEEINFLUSSUNG DES GUSSGEFUEGES VON ALUMINIUM-STRANGGUSS DURCH GIESSBEDINGUNGEN UND VERFAHRENSTECHNIK]
A. F. Steinegger 24 Jun. 1970 15 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 60, no. 10, Oct. 1969, p 735 – 741
(NLL-M-9232-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The process technology of continuously cast aluminum is discussed with respect to the casting temperature, casting rate, and heat dissipation from the solidification front. Based on a table providing recommended measures in process technology, selected examples are given for mechanisms involved in the process. R.B.

N70-38692# State Univ. of New York at Buffalo. Faculty of Engineering and Applied Sciences.
LATERAL VIBRATION OF A NONLINEAR VISCOELASTIC BEAM UNDER INITIAL AXIAL TENSION
F. A. Cozzarelli, J. Wu (Westinghouse Electric Corp., East Pittsburgh, Pa.), and S. Tang (Lockheed Missiles and Space Co., Sunnyvale, Calif.) Dec. 1969 39 p refs
(Contract Nonr-4449(00))
(AD-706783; Rept-33) Avail: CFSTI CSCL 20/11

The free latural vibration of a simply-supported metallic beam under axial creep deformation is considered. The constitutive law is formulated with stress power functions in the primary and secondary creep terms; the instantaneous linear elastic deformation is also included. For better physical visualization, a nonlinear Maxwell-Kelvin model is used to represent the constitutive law. A reduction to various special models is also obtained. It is assumed that the initial stress is much greater than the increments of stress caused by the oscillation, and a perturbation technique is employed. In the present study, the perturbation essentially results in replacing a nonlinear viscoelastic problem by an equivalent linear viscoelastic problem. Analytical solutions for the Maxwell-Kelvin model and for the special models are obtained. Numerical results for a stainless steel and an aluminum alloy are also presented and discussed. Author (TAB)

N70-38746# Sandia Corp., Albuquerque, N. Mex.
MAT2D: A PLANE STRESS MATERIAL MODEL FOR AN ELASTIC PLASTIC ANISOTROPIC STRAIN HARDENING MATERIAL
G. W. Barr and E. G. Young Jan. 1970 79 p refs
(SC-RR-69-656) Avail: CFSTI

The material modeling concept developed to characterize the non-linear strain-hardening behavior of a real material with a suitable combination of elastic-perfectly plastic elements arranged in parallel is used to develop a numerical material model for structural response calculations. The modeling concept is extended to approximate the response of a completely anisotropic material in the elastic range. However, in the plastic range each element of the model is restricted by the Huber – von Mises yield criterion to behave as an isotropic material. This does not imply that the combined plastic response of the model elements is that of an isotropic material. An advantage of modeling the material in this fashion is that an explicit strain-hardening law is not required in the formulation. Special care has been taken to evaluate the flow rules on the yield surface for each elastic-perfectly plastic element to ensure that the stress state remains on the yield surface during plastic deformation. Author (NSA)

N70-38772 California Univ., Los Angeles.
A UNIFIED ANALYSIS OF INELASTIC PLATES
Ernest Yu-seng Ho (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-17560

A unified theory for inelastic plates is formulated for elastically isotropic materials by establishing an equivalence between the inelastic strains in the plate and the applied lateral loads, in-plane forces, and edge moments. By considering the inelastic strains as additional applied loads, the general inelastic plate problem can always be reduced to a set of two elastic problems: a plane stress problem and a plate bending problem. The solution for elastic plates under arbitrary lateral loads in general are known. There are also standard computer routines available for the plane stress problem with arbitrary geometry subjected to arbitrary body and edge loadings. Therefore, the influence coefficients of stress and displacement due to unit point loads can be easily established for both problems. The solution of the inelastic plate problem is then obtained by solving successively the reduced plane stress problem and the plate bending problem. When large deflection of plates is considered, the reduced problems become coupled and nonlinear. In such cases, the concept of equivalent loads is extended to nonlinear strains as well. Then the problems can be solved by using a supplementary iteration procedure. Dissert. Abstr.

N70-38773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOELASTIC STRESSES IN A SYSTEM OF THREE-LAYER CYLINDERS
P. S. Solomin 4 Feb. 1970 14 p ref Transl. into ENGLISH from Uch. Zap. Tomsk. Gos. Univ. (USSR), no. 68, 1967 p 117 – 125
(AD-706185; FTD-HT-23-640-69) Avail: CFSTI CSCL 13/13

The solution is given of a plane problem of transient temperature stresses in a hollow three layer cylinder. The problem is discussed in a quasi-static formulation. The thermal conductivity equation is solved by the operator method. The solution of the thermoelasticity problem is found by using the permutation potential and the Erie function of stresses. TAB

N70-38793# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATIONSHIP OF A LOAD, CAUSING FLUTTER OF MILDLY SLOPING SHELL OF REVOLUTION, TO THE SHAPE OF PROFILE AND CALCULATION OF THERMOBIMETALLIC MEMBRANES
E. L. Akelrad 30 Mar. 1970 14 p refs Transl. into ENGLISH from Sb. Tr., Inst. Inzhenerov Zheleznodorozhnogo Transporta (USSR), v. 249, 1966 p 187 – 194
(AD-707103; FTD-MT-24-43-70) Avail: CFSTI CSCL 13/13

Stability of a hinged, supported, bimetallic, mildly sloping shell of revolution with an arbitrary curve is investigated. The shell is acted upon by an axial force and a temperature dispersion varying with thickness. A deformation curve corresponding to the given value of axial force, is obtained as a result of applying the Bubnov-Galerkin method to the nonlinear equations of axial-symmetric equilibrium of such a shell with one variable

parameter. The temperature which causes cracking in a shell of this or that shape, is determined by the maximum point of the curve. In addition, the lease ratio H/h (H is the ascent indicator, h the shell thickness) at which the shell flutters is determined. From an experimental study it is established that the initial stresses, produced during production of the shell, may be the source of a significant variance in the critical value of temperature. Eliminating these stresses increases stability of the construction under study. Author (TAB)

N70-38803 Georgia Inst. of Tech., Atlanta.
ROTATIONALLY SYMMETRIC VIBRATIONS OF ORTHOTROPIC LAYERED CYLINDRICAL SHELLS
Teh-Min Hsu (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-18610

Development of a consistent theory from a fundamental view point for the analysis of laminated cylindrical shells consisting of layers of orthotropic laminae is presented. Analysis for the rotationally symmetric vibrations of such shell system is studied in detail, and numerical results based on the present analysis are made and compared to the results obtained according to existing theories. Each layer is considered separately but coupled by interacting loads between every two adjacent layers of such laminated structural systems. The method of analysis is very flexible. Although the numerical results are presented for shells with fixed edges, yet the method is applicable to cylindrical shells of finite length with any other edge supporting conditions. According to the numerical results for a single-layered shell, it is found that for short shells, the transverse shear deformation becomes significant and the differences between present analysis and classical analysis are large even for a very thin shell with radius to thickness ratio of 100. Dissert. Abstr.

N70-38805# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE STRESSED STATE IN LAMINAR SPHERICAL SHELLS
A. P. Mukoed 4 Feb. 1970 8 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. A, Fiz.-Tekhn. Ta Mat. Nauki (Kiev), v. 31, no. 1, 1969 p 45–48
(AD-706184; FTD-HT-23-639-69) Avail: CFSTI CSCL 20/11

The stress distribution in a thin spherical shell consisting of orthotropic layers and subjected to internal pressure is examined. It is assumed that the hypothesis of straight normals is valid for the pack of layers as a whole, and that the principal axes of orthotropy in each layer coincide with the directions of coordinate axes. The basic homoegenous equation (previously derived by the author in terms of Novozhilovs function) of axisymmetrical deformation of the above mentioned shell and its solution (containing Legendres functions of the first and second kind) are used in obtaining expressions for stresses comprising associated Legendre functions. The latter are replaced by hypergeometric Gauss functions, and formulas in series form (suitable for computer calculation) for determining the forces and moments are derived. For cases where the calculations present mathematical difficulties, another solution (of the edge effect type) in asymptotic representation by means of the Bessel and Hankel functions is given. Author (TAB)

N70-38822 Utah Univ., Salt Lake City.
ENERGY PARTITIONING IN HIGH-VELOCITY-IMPACT CRATERING
Gerry H. Turner (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-18634

Methods are presented for determining kinetic energy partitioning among various competing processes occurring in high-velocity-impact cratering in lead targets. Target heating, ejection of material (spray particles) from the crater, and formation of new grain boundaries in the target material are considered. The target is considered as a calorimeter and a thermo-couple is used to measure its temperature change. The energy involved in the heating action is then calculated from this change. A trap is used to catch the particles and their energy is determined from the temperature change of the trap. Grain-boundary energy is assumed to be the difference between the projectile kinetic energy and the sum of target-heating and spray-particle energies. Energy of deformation of lead is determined from measurements involving low-velocity impact of identical lead cylinders. This energy is then related to deformation in impact craters. The formation of Meteor Crater, Arizona is discussed. Dissert. Abstr.

N70-38824 Stanford Univ., Calif.
STRESS WAVES CAUSED BY A LOAD ACCELERATING THROUGH A CRITICAL SPEED
William James Stronge, Jr. (Ph.D. Thesis) 1969 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-17455

Solutions for the response of an infinitely long string and an acoustic half-space to accelerating transverse loads are obtained (the acceleration may be any prescribed function of time). For the string and the half-space the critical speeds correspond to the free wave (sonic) speed c. Nothing critical occurs if any distributed force (pressure) has a front which accelerates through c, however, a concentrated force moving on the string does cause a vertical slope, which is critical, as it accelerates through c. This is due to the over-idealization of the load. By considering loads which move at the free wave speed for a finite time, these speeds are shown to be resonant rather than critical. The special case of constant load speed is examined further for implications of the steady wave assumption. Necessary conditions for steady waves moving with a force over a string are obtained. Dissert. Abstr.

N70-38872# Technische Hochschule Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
CALCULATIONS AND MEASUREMENTS ON THE STRESS BEHAVIOR IN ROTATING SHELLS Technical Report, 1 Jul. 1963 – 31 Jan. 1968
Wilhelm Dettmering and Wilhelm B. Soetebeer Mar. 1970 176 p refs
(Contract AF 61(052)-669)
(AD-706391; AFML-TR-70-64) Avail: CFSTI CSCL 20/11

The stress analyses of rotating shells were aimed at developing a suitable method of calculation which takes into account, as closely as possible, the complicated wheel designs as found, for instance, in the centrifugal flow impeller. As in the theoretical treatment simplifications are required to be made, the theoretical calculations are confronted with experimental investigations. For the experimental investigations a test stand was developed by means of which, and applying a suitable measuring procedure, quasi-static measurements of high accuracy could be carried out on rotating models. The first section of the report contains detailed information on the facts and figures made available for calculation. The second section deals with the experimental work and the test results. On five wheel designs that were selected, the stress and strain distributions obtained by calculation and measurement were compared with each other. Author (TAB)

N70-38875# Picatinny Arsenal, Dover, N.J.
AN IMPROVED COMPUTER PROGRAM TO CALCULATE THE AVERAGE BLAST IMPULSE LOADS ACTING ON A WALL OF A CUBICLE
Stuart Levy May 1970 52 p
(AD-707362; PA-TR-4070) Avail: CFSTI CSCL 19/4

An improved computer program was formulated to calculate

the average blast impulse loads acting on a wall of a cubicle when an explosive charge is detonated within the cubicle. It was devised by the Ammunition Engineering Directorates Process Engineering Laboratory in connection with the Safety Design Criteria Program and it simplifies an earlier computer program used to calculate data points for the construction of impulse charts in Technical Manual 5-1300, Structures to Prevent the Effects of Accidental Explosion. Author (TAB)

N70-38879# Sandia Corp., Albuquerque, N.Mex.
SCALING LAWS FOR FUEL CAPSULES SUBJECTED TO BLAST, IMPACT, AND THERMAL LOADING
T. A. Duffey May 1970 45 p refs
(SC-RR-70-134) Avail: CFSTI

Scaling laws are reviewed and developed for the large deflection transient response of structures governed by nonlinear constitutive relationships. The results are interpreted in terms of the response of fuel capsules to blast, fragment impact, earth impact, and thermal loading. It is shown that generally fuel capsules can be simulated during testing by small scale capsule models by identical materials as the prototypes, and in certain instances by models constructed of dissimilar materials. Problem areas for both testing techniques are isolated. The scaling laws are shown to be supported by an independently developed analysis of a blast loaded structure undergoing elastic-plastic behavior. Author (NSA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-37676# Argonne National Lab., Ill.
REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION Annual Report, Jul. 1968 - Jun. 1969
A. A. Jonke, E. L. Carls, R. L. Jarry, M. Haas, W. A. Murphy et al Jun. 1969 62 p refs
(Contract W-31-109-eng-38)
(ANL/ES-CEN-1001) Avail: CFSTI

Fluidized bed combustion of fossil fuels, to which particulate limestone is added to react with sulfur oxides, is studied as a means of reducing emission of the sulfur dioxide released during combustion. Results of a literature survey and development of an empirical model to relate laboratory-obtained kinetic data on the reaction rates of limestone and SO2 to the fluidized bed operating parameters are discussed. Results of bench-scale experiments using a 6 in. diameter fluidized bed combustor operated at a superficial gas velocity of 3 ft/sec are given. Data are presented on the combustion efficiency of the fluidized bed system, the extent of limestone calcination during combustion, the solids elutriation rates, and the distribution of particle size of elutriated solids. Nitrogen oxide concentrations in the flue gas during fluidized bed combustion, the sources of nitrogen, and the reduction in NO concentration observed when limestone was added to the fluidized bed are also discussed. Author

N70-37727# California Univ., Livermore. Lawrence Radiation Lab.
FED: A COMPUTER PROGRAM TO GENERATE GEOMETRIC INPUT FOR THE HEAT TRANSFER CODE TRUMP
Dale A. Schauer 10 Feb. 1970 95 p refs
(UCRL-50816) Avail: CFSTI

The FED computer program reduces the effort required to obtain the necessary geometric input for problem solutions using the heat-transfer code TRUMP. (TRUMP, a computer program, calculates transient and steady-state temperature distributions in multidimensional systems.) FED can properly zone any body of revolution in one, two, or three dimensions. Rectangular bodies can be only appproximated by using a very large radius of revolution compared to the total radial thickness and by considering only a small angular segment in the circumferential direction. First the region of interest must be divided into areas which may consist of a common material. The boundaries of these areas are the required FED input. Each area is subdivided into volume nodes and the geometrical properties calculated. Finally, FED connects the adjacent nodes to one another, using the proper surface area, interface distance, and, if specified, radiation form factor and interface conductance. Author

N70-37732# Temple Univ., Philadelphia, Pa. Dept. of Physics.
EXPLODING WIRE PHENOMENA Final Report, 1 Mar. 1967 - 28 Feb. 1970
Theodore Korneff, William Simmons, and Herbert Goronkin 31 Mar. 1970 127 p refs
(Contract F19628-67-C-0250)
(AD-707151; AFCRL-70-0224) Avail: CFSTI CSCL 19/1

This report describes experiments to determine the shunting effect of occluded and self generated vapor produced by an exploding wire in a vacuum: The investigation of the striation mechanism in exploding wires, (these striations have been examined by high speed sequential framing camera to see if they have an axial drift); Calculations on the order of magnitude of the Hall energy, (results show that for a given sample, about 13% more energy is required to melt the sample than is accounted for in simple thermodynamic arguments); The development of an experimental flash x-ray technique for determining the instantaneous density of the vapor produced by an exploding wire; and The development of a three-color optical pyrometer with fast response time. (The unit, in breadboard form, has been calibrated, and used to obtain preliminary results from exploding wires. The results are expressed in the form of a trace on a cathode ray oscilloscope, whose vertical displacement is proportional to the temperature. Author (TAB)

N70-37842*# General Dynamics/Convair, San Diego, Calif.
TRANSITIONAL AND TURBULENT HEAT TRANSFER CORRELATIONS FOR A LIFTING ENTRY VEHICLE AT MACH 10
C. H. Young, D. C. Reda, and A. M. Roberge *In* NASA, Washington Space Transportation System Technol. Symp., Vol. 1 Jul. 1970 p 418 - 443 (See N70-37826 21-31)
Avail: CFSTI CSCL 22C

Wind tunnel tests were conducted on a lifting entry vehicle of relatively simple geometry to obtain data on boundary layer transition and turbulent heat transfer. Applicability of the results of these tests to space shuttle are discussed. Particular attention is given to Reynolds number and angle of attack effects on transition and turbulent flow on the vehicle lower surface centerline. Correlations with existing heat transfer prediction techniques are shown for selected portions of the data. Results concerning onset of transition and a possible mechanism for observed transition behavior are presented. Length of the transition zone and heat transfer variation through the transitional region are described. Author

N70-37856 Oregon State Univ., Corvallis.
A NUMERICAL SOLUTION FOR HEAT TRANSFER TO NON-NEWTONIAN FLUIDS WITH TEMPERATURE-DEPENDENT VISCOSITY FOR ARBITRARY CONDITIONS OF HEAT FLUX AND SURFACE

TEMPERATURE
Glenn Frank Cochrane, Jr. (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-19461

A numerical solution is presented for the coupled energy and momentum equations for steady, laminar flow of temperature-dependent power-law non-Newtonian fluids. A Newtonian fluid can be handled as a special case. Two important geometrical cases are considered: (1) pipe flow, and (2) channel flow between two flat, parallel plates. For pipe flow the dimensionless energy equation and the dimensionless momentum equation are solved simultaneously; the Crank Nicolson method is used for writing the second partial derivatives. A digital computer is used to solve the resulting numerical equations. For channel flow the corresponding equations are solved with the terms in volving curvature deleted. Computed results giving heat transfer information in the form of Nusselt number and pressure drop as a dimensionless pressure differential are presented for a number of heating conditions. Complete listings of the CDC 330 Fortran programs are included. Dissert. Abstr.

N70-37888# Notre Dame Univ., Ind. Coll. of Engineering.
THERMODYNAMIC ANALYSIS OF UNDERWATER STEAM JET PROPULSION
Robert J. Young, Kwang-Tzu Yang, and Jerome L. Novotny Mar. 1970 39 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-706370; THEMIS-UND-70-7) Avail: CFSTI CSCL 21/5

The thermodynamic analysis of an underwater steam jet propulsion system for generation of high underwater speeds is presented. Considered as parameters for this study are ocean depth, vehicle size, maximum steam temperature, total drag coefficient, and power. The study has shown the dependence of both vehicle speed and jet mass flow rate on these parameters in the form of correlations. Although the analysis is independent of operational limits, comparisons are made whenever possible to present technological capability as described in the open literature. Author (TAB)

N70-37902 Utah Univ., Salt Lake City.
ACOUSTIC INSTABILITY IN THE COMBUSTION OF METHANE-OXYGEN-NITROGEN MIXTURES
William Walter Sipowicz (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms : HC $6.60/Microfilm $3.00 Order No. 69-18679

The development and use of a gas-fired T-burner, patterned after the solid propellant T-burner, are described. Combustion runs made with methane as fuel and nitrogen oxygen mixtures as oxidizer are reported. Gas burner behavior is shown to be remarkably similar to that of the T-burner. Linear growth constants are measured reproducibly over a wide range of run conditions. Growth constants are correlated with several independent variables, the most important being the equivalence ratio of the feed gas. A maximum occurs near the point of maximum energy release; another maximum is seen near the lean ignition limit. The effects of variations in frequency, mass flow rate, and nitrogen dilution are also reported. It is postulated that gas phase kinetics plays a significant role in oscillatory combustion. A slot-grooved device contributed linear damping of up to 50/cm to the system. Dissert. Abstr.

N70-37906 Missouri Univ., Rolla.
THE STATISTICS OF FINITE, ONE DIMENSIONAL LATTICE FLUIDS
John Roger Glease (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-19426

A one dimensional lattice fluid in which particles are allowed to assume only discrete positions is proposed. Particles are free to move from one lattice site to another interacting through a variety of potentials, including the Lennard-Jones type. The model allows the partition function to be evaluated as a discrete sum over the allowable configurations. Both the canonical ensemble and grand ensemble are treated by computer and a third, the pressure ensemble, is considered and shown to be useful in the theoretical treatment of lattice systems. The thermodynamic behavior of various systems is investigated in both the canonical and grand ensembles. Both ensembles reveal that low temperature behavior of a system is distinctly different than that observed at high temperatures although there is not exact agreement between the two results. Dissert. Abstr.

N70-37908 California Univ., Berkeley.
THE INTERPLAY OF SURFACE TENSION, INERTIAL, AND GRAVITATIONAL FORCES IN THE NUCLEATE BOILING "BURNOUT" HEAT FLUX
Ginton Shelef (Ph.D. Thesis) 1969 186 p ref
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-18969

The objectives of the research were: (1) to find out what causes the apparent existence of nucleate boiling and peak nucleate boiling flux (PNBF) for a horizontal heated flat surface facing down; and (2) to explore the interrelationship of surface tension, gravitational and inertial forces in nucleate boiling. The heat flux from an insulated, flat, circular copper test surface surrounded by a coplanar fin and submerged in a saturated pool of boiling Freon 11 was measured as a function of the temperature difference between the copper test surface and the boiling liquid for tilts of the surface ranging from 0 degrees, horizontal face down, to 180 degrees, horizontal face up. Measurements were made at six bath temperatures ranging from 270 to 332 K. In order to control the vapor bubbles' flow, two stainless-steel fins were used; a 5 in. fin and a 1 in. fin. Heat inputs and temperatures were measured primarily in the nucleate boiling regime with emphasis on the measurement of the peak nucleate boiling fluxes. Dissert. Abstr.

N70-37920 Purdue Univ., Lafayette, Ind.
RADIATION HEAT TRANSFER IN A NONGRAY PLANAR MEDIUM
Alfred Linden Crosbie (Ph.D. Thesis) 1969 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-17164

The problem of nongray radiative transfer in an absorbing and emitting medium capable of conducting and generating heat is studied analytically. The temperature distribution, local, and total heat fluxes are predicted for a planar medium bounded by two parallel plates. The spectral absorption coefficient is assumed to be a separable product function of frequency and temperature. The absorption coefficient considered includes the rectangular, triangular, exponential, Lorentz, and Doppler models. Using exact radiative transfer theory, the energy equation becomes a nonlinear integrodifferential equation for the temperature distribution. Dissert. Abstr.

N70-37979* National Aeronautics and Space Administration. Langely Research Center, Langely, Station Va.
SANDWICH PANEL CONSTRUCTION Patent
Roger A. Anderson and Robert T. Swann, inventors (to NASA) Issued 21 May 1963 (Filed 27 Sep. 1961) 6 p Cl. 62-467
(NASA-Case-XLA-00349; US-Patent-3,090,212;
US-Patent-Appl-SN-141220) Avail: US Patent Office

A sandwich structure for removing heat accumulating in a heat shield or barrier between an area of high heat concentration is described. Spray tubes are positioned within alternate corrugations of the core element, and are adapted to spray water or other liquid coolant onto absorbent wicking material on the inside of one portion of the panel. A heat shield element is operatively coupled

with this portion of the panel adjacent to the area of high heat concentration. Heat on the shield is transferred to the panel, causing evaporation of the coolant, which then leaves through exhaust conduits. The structure has applications such as furnace walls, heat shields, or high speed aerospace vehicles. N.E.N.

N70-38043# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.

DESCRIPTION OF THE 9 MW HEAT TRANSFER RIG

J. D. Obertelli and O. R. Owen Aug. 1969 23 p

(AEEW-M-935) Avail: AEC Depository Libraries

The 9 MW heat transfer rig consists basically of a high pressure water loop with which heat transfer and flow resistance data are obtained for a variety of test sections including rod clusters simulating full scale the fuel element design for the steam generating, heavy water reaction system. The rig and cluster test section design are described together with the associated instrumentation. The extent of the simulation in these tests of the actual reactor situation is also identified. Author (NSA)

N70-38076# McDonnell-Douglas Co., Richland, Wash. Donald W. Douglas Labs.

PRELIMINARY PROGRAM PLAN HEAT PIPE PARAMETRIC DATA

J. S. Holmgren Aug. 1969 22 p refs

(DWDL-698-008) Avail: CFSTI

A program is described which is designed to provide parametric heat pipe performance data which can be used by spacecraft designers, with only a limited knowledge of heat pipe theory, to perform tradeoff studies and generate preliminary system designs. The type of data to be generated and the basis for the selection of components and the range of parameters to be investigated are described. Parametric curves of thermal performance and weight are generated as a function of temperature and various other parameters such as length and thermal input profile. In addition, parametric data for controllable heat pipes are developed. Heat pipe operation is discussed where the basis for design data is shown. DWDL experience and facilities available for successful performance of this program are presented. Author

N70-38119# Toronto Univ. (Ontario). Inst. for Aerospace Research.

COMBUSTION, EXPLOSIONS AND HYPERVELOCITY

In its [Inst. for Aerospace Res.] Nov. 1969 p 14-25 refs (See N70-38116 21-01)

Avail: CFSTI

During the past year theoretical and experimental investigations were conducted in the two major developed areas associated with the UTIAS Implosion-Driven Hypervelocity Launcher and the 4 in × 7 in Hypervelocity Shock Tube, as well as the developing areas of micrometeroid impact and sonic boom. The launcher program has been especially fruitful in providing research and development investigations in combustion and explosions in a spherical geometry at high pressures. Some major items in the launcher program that were considered this year are as follows: The completion of the design of the 24 in dia Mk II Launcher, which is theoretically capable of accelerating a 13 g, 1 in dia, right circular cylinder to 50 k ft/sec by using about 50 lb of PETN, marks an important step. A third-scale model of this novel launcher is now in operation and undergoing calibration tests. Spectroscopic temperature measurements have also been made of gas-driven implosions and their agreement with improved numerical calculations are very satisfactory. Microwave measurements of the projectile velocities within the launcher barrel agree quite well with numerical predictions for early times. Author

N70-38127# Toronto Univ. (Ontario). Inst. for Aerospace Research.

HIGH TEMPERATURE GAS DYNAMICS AND GAS PHYSICS

In its [Inst. for Aerospace Res.] Nov. 1969 p 97-105 refs (See N70-38116 21-01) Avail: CFSTI

Developmental difficulties in the UTIAS shock gun tunnel are reported. The principal problem has been unstable combustion in the driver particularly when diluent gases of high molecular weight were used. Other problems and the overall effect on the project are discussed. Development of the electron beam probe for use in the tunnel has also been plagued with difficulties. Theoretical work on the hypersonic corner expansion problem and some preliminary results are discussed. Other work reported in our hypersonic flow activities is an examination of the applicability of simple approximate theories in hypersonic flow calculating surface pressure on concave surfaces. Author

N70-38141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEAT TRANSFER AND SECOND SOUND IN DIELECTRICS WITH LARGE DRIFT VELOCITIES OF A PHONON GAS

H. Nielsen et al 2 Feb. 1970 17 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 56, no. 2, 1969 p 709-717

(AD-706178; FTD-HT-23-617-69) Avail: CFSTI CSCL 20/13

Nonlinear hydrodynamic equations are derived which describe the motion of a phonon gas in a dielectric at low temperatures. Author (TAB)

N70-38251# National Bureau of Standards, Washington, D.C.

PRECISION MEASUREMENT AND CALIBRATION: HEAT

Defoe C. Ginnings, ed. Feb. 1970 386 p refs

(NBS-SD-300-Vol-6) Avail: SOD $5.00

Calorimeters and other temperature measuring instruments are described and their applications in low- and high temperature kinetics outlined. The emphasis is on calorimetry and heat transfer measurements. For individual titles, see N70-38251 through N70-38280.

N70-38252# National Bureau of Standards, Washington, D.C.

CALORIMETRY OF NON-REACTING SYSTEMS: INTRODUCTION

Defoe C. Ginnings *In its* Precision Meas. and Calibration Feb. 1970 p 1-14 refs Submitted for publication (See N70-38251 21-33)

Avail: SOD $5.00

The principal fundamental physical quantities measured in calorimetry are temperature, energy, and mass. Whereas the first two are covered the techniques for measuring mass are so generally known or available, that no treatment is given here. In calorimetry it is frequently necessary to measure other quantities such as pressure and volume. Since measurements of these two quantities are usually secondary in calorimetric measurements, a discussion of them will be deferred to Volume II. For the student in calorimetry, a brief bibliography is given. The field of reacting systems has recently been covered and some of the techniques are applicable to non-reacting systems. Author

N70-38253# National Bureau of Standards, Washington, D.C.

PRINCIPLES OF CALORIMETRIC DESIGN

Defoe C. Ginnings and E. D. West *In its* Precision Meas. and Calibration Feb. 1970 p 15-61 refs Submitted for publication (See N70-38251 21-33)

Avail: SOD $5.00

The specific design of calorimetric apparatus involves mechanical, chemical, electrical, thermal, and perhaps other properties of construction materials. Usually, the actual design is a compromise

with at least some of these properties. For example, it may be necessary to sacrifice mechanical rigidity to obtain low thermal conductance in certain parts, or in selecting the size of the calorimeter heater current leads, it is necessary to comprise between electrical heat developed in the leads and thermal conductance of the leads. Some discussion will be given of the mechanical, chemical, and electrical design factors, but emphasis is placed on the consideration of heat flow. Author

N70-38254# National Bureau of Standards, Washington, D.C.
CALORIMETRY OF SATURATED FLUIDS INCLUDING DETERMINATION OF ENTHALPIES OF VAPORIZATION
Defoe C. Ginnings and H. F. Stimson *In its* Precision Meas. and Calibration Feb. 1970 p 62-87 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

Discussed is the calorimetry of saturated fluids. From experimental measurements values of enthalpy of vaporization, heat capacities and derived thermodynamic quantities were obtained. Four calorimeters are described, three for water to pressures of 218 atm in the temperature range 0-374 C, and one for hydrocarbons near 25 C. An effort has been made to discuss the advantages and disadvantages, both of the method and various experimental features. Author

N70-38255# National Bureau of Standards, Washington, D.C.
HEAT CAPACITY OF A TWO PHASE SYSTEM, WITH APPLICATIONS TO VAPOR CORRECTIONS IN CALORIMETRY
Harold J. Hoge *In its* Precision Meas. and Calibration Feb. 1970 p 88-95 refs Submitted for publication (See N70-38251 21-33)
(NBS-RP-1693) Avail: SOD $5.00

A formula is derived that gives the heat capacity of a system composed of solid or liquid in equilibrium with saturated vapor in terms of the specific heat of the condensed phase and certain auxiliary data. This formula is valid throughout the entire range from 0 to 100 percent of vapor, and at the latter extreme reduces to a well-known relation between the specific heats of saturated liquid and saturated vapor. The formula is applied to the calculation of vapor corrections in calorimetry. Its advantage lies in the fact that the correction is expressed as a single term that may be readily transformed with Clapeyron's equation, yielding two alternative correction formulas. Vapor corrections to the heat capacity and to the heat of fusion are summarized and tabulated for four different experimental procedures in calorimetry. Author

N70-38256# National Bureau of Standards, Washington, D.C.
HEATING RATE AS A TEST OF ADIABATIC COLORIMETERS AND THE HEAT CAPACITY OF ALPHA-ALUMINA
Estal D. West *In its* Precision Meas. and Calibration Feb. 1970 p 96-99 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

The constancy of heat capacities measured in an adiabatic calorimeter at different heating rates does not demonstrate the absence of heat leak errors due to departures of the surface temperature from the "isothermal" condition. On the contrary, the total heat exchange between the calorimeter and its shield is virtually independent of the heating rate. The tests tend to obscure a real source of error due to the variation in the total heat exchange between experiments with the empty and the full calorimeter. Author

N70-38257# National Bureau of Standards, Washington, D.C.
A TWO BODY MODEL FOR CALORIMETERS WITH CONSTANT TEMPERATURE ENVIRONMENT
Estal D. West and Kenneth L. Churney *In its* Precision Meas. and Calibration Feb. 1970 p 100-109 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

Equations are derived describing a model of isoperibol calorimeter in which the calorimeter proper consists of two parts thermally connected, one surrounding the other and exchanging heat with the constant-temperature environment. These solutions provide insights into the behavior of real calorimeters. Inferences are drawn relative to the effect of the locations of the thermometer and heat source on the energy equivalent of the calorimeter and some possible errors are pointed out. Macleod's application of the two-body theory of King and Grover to high-temperature enthalpy measurements is discussed and weaknesses in theory and experiment are pointed out. Procedures having a better theoretical basis are outlined. Author

N70-38260# National Bureau of Standards, Washington, D.C.
CALORIMETRIC DETERMINATION OF THE HALF-LIFE OF POLONIUM
Defoe C. Ginnings, Anne F. Ball, and D. T. Vier (Los Alamos Sci. Lab., Livermore, Calif.) *In its* Precision Meas. and Calibration Feb. 1970 p 112-116 refs Submitted for publication (See N70-38251 21-33)
Avail: CFSTI

The heats of radioactivity of four samples of polonium have been measured with a Bunsen ice calorimeter over a period of about seven months. With samples ranging in initial powers for 0.17 to 1.4 watts, the half-life values calculated from these measurements were found to agree within 0.1 percent, or the equivalent of 0.0003 watt, whichever was the larger. The results with the sample with the largest power gave a half-life value of 138.39 days, with an uncertainty of 0.1 percent (0.14 day). This is in agreement with the value of 138.3 days (+ or - 0.1 percent) reported by Beamer and Easton, who used a different calorimetric method. Author

N70-38261# National Bureau of Standards, Washington, D.C.
HEATS OF TRANSFORMATIONS IN BISMUTH OXIDE BY DIFFERENTIAL THERMAL ANALYSIS
Ernest M. Levin and Clyde L. Mc Daniel *In its* Precision Meas. and Calibration Feb. 1970 p 117-123 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

DTA was chosen as a convenient method for resolving differences in the reported heat of transition and heat of fusion of Bi2O3. The heat of the low to high transition of K2SO4 (at 583 C) and the heat of fusion of Ag (at 960.8 C) were used as internal standards. These standards were mixed directly with the Bi2O3 in three weight ratios. The heating schedule for each weight ratio was 3 deg/min, 9 deg/min, and 3 deg/min. For evaluating internal consistency, DTA determinations were made for mixtures of the two standards. Linearity was obtained within limits between the weight ratio of Bi2O3 and standard and the corresponding ratio of peak areas. The heat of transition of Bi2O3 was found to be 9.9 + or - 0.5 kcal/mole and the heat of fusion 3.9 + or - 0.2 kcal/mole. The uncertainties are estimated limits of error, based on internal consistency and on the values of the standards. Author

N70-38268# National Bureau of Standards, Washington, D.C.
DETECTION AND DAMPING OF THERMAL-ACOUSTIC OSCILLATIONS IN LOW TEMPERATURE MEASUREMENTS
David A. Ditmars and George T. Furukawa *In its* Precision Meas. and Calibration Feb. 1970 p 175-178 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

The spontaneous thermal-acoustic oscillations in nonisothermal columns of helium, hydrogen, nitrogen, argon, and oxygen gas have been investigated. The pressure fluctuations were measured with

a barium titanate transducer and the particle displacements observed by a smoke technique. The observed pressure oscillations were often nonsymmetrical and of sufficient amplitude to indicate the necessity for a nonlinear approach in a theoretical treatment of the oscillations. An adjustable "Helmholtz resonator" attached at the warm end of the oscillating column was found to damp completely the oscillations and eliminate the energy transfer which they caused. Author

N70-38267# National Bureau of Standards, Washington, D.C.
HIGH TEMPERATURE DROP CALORIMETRY
Thomas B. Douglas and Edward King (Bur. of Mines, Albany, Oreg.) *In its* Precision Meas. and Calibration Feb. 1970 p 181-219 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

At present, enthalpies of solids and liquids must be determined experimentally; and most of the accurate data for solids and liquids, above 100 C, have been provided by drop calorimetry. With this method a sample is heated to a known temperature and is then dropped into a calorimeter (usually operating near room temperature), which provides measurement of the heat evolved by the sample in cooling to the calorimeter temperature. Currently the major applications of entahalpy and enthalpy-related data are to problems in microstructure, heat transfer, and chemical thermodynamics. In particular, the last application is of great importance. If room-temperature values of enthalpy, Gibbs energy, or entrophy have been obtained by other means, the values may be extended to the limit of the high-temperature measurements. In many cases equilibrium vapor pressures can be calculated more accurately than they can be directly measured. If vapor pressure measurements do exist, the measured enthalpies and derived data can be used in a complementary way. Author

N70-38268# National Bureau of Standards, Washington, D.C.
A CALORIMETRIC DETERMINATION OF THE ENTHALPY OF GRAPHITE FROM 1200 TO 2600 K
Estal D. West *In its* Precision Meas. and Calibration Feb. 1970 p 220-226 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

Measurements are reported of the increase in the enthalpy of high-purity graphite between room temperature and 1200 to 2600 K. A new apparatus is described briefly. Methods of operation are developed which eliminate some systematic and random errors and are especially advantageous at high temperatures. The enthalpy data fit the equation. Author

N70-38270# National Bureau of Standards, Washington, D.C.
PRECISE MEASUREMENT OF HEAT OF COMBUSTION WITH A BOMB CALORIMETER
R. S. Jessup *In its* Precision Meas. and Calibration Feb. 1970 p 237-261 refs Submitted for publication Supported in part by AF *Its* Monograph No. 7 (See N70-38251 21-33)
Avail: SOD $5.00

Given are detailed descriptions of apparatus and methods which are used for precise determinations of heats of combustion of liquid hydrocarbon fuels. Numerical examples are given of methods of calculating results of measurements from observed data. The technique of making and filling glass bulbs to contain samples of volatile liquid fuels is described. The accuracy of 0.01 or 0.02 percent attained in certain measurements on pure compounds, and the accuracy of several tenths of one percent obtainable with published standard procedures for measurements on fuels. Author

N70-38273# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
STUDIES IN BOMB CALORIMETRY. A NEW DETERMINATION OF THE ENERGY OF COMBUSTION OF BENZOIC ACID IN TERMS OF ELECTRICAL UNITS
K. L. Chumey and G. T. Armstrong *In its* Precision Meas. and Calibration Feb. 1970 p 275-287 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

The heat of combustion of benzoic acid under standard bomb conditions has been determined in terms of electrical units. A value of -26,434.0 J 0.1g was obtained. The total uncertainty in our determination is estimated to be + or - 3.3 J 0.1 g. The uncertainty due to random errors was 1.7 J 0.1 g and is based on the appropriate factors for the t distribution at the 95 percent confidence limits for eleven determinations of the energy equivalent of the calorimeter and six determinations of the heat of combustion of benzoic acid. The principal systematic error, neglect of surface temperature correction for our calorimeter, has been assigned a value of + or - 2.6 J 0.1 g until more reliable estimates of the correction can be made. Particular emphasis was placed on improving the precision of a calorimetric measurement over those previously obtained in this laboratory by the use of more sensitive auxiliary measuring equipment and more accurate procedures to evaluate the corrected temperature rise. Author

N70-38275# National Bureau of Standards, Washington, D.C.
HEAT CONDUCTION THROUGH INSULATING SUPPORTS IN VERY LOW TEMPERATURE EQUIPMENT
R. P. Mikesell and R. B. Scott *In its* Precision Meas. and Calibration Feb. 1970 p 309-316 refs Submitted for publication Supported in part AEC (See N70-38251 21-33)
Avail: SOD $5.00

An apparatus is described that is used to measure the heat conduction through insulating supports of storage vessels for cryogenic liquids and presents the data obtained from the conduction measurements. Two types of supports were tested: (1) multiple-contact supports in the form of stacks of thin metallic plates or spirally wound strips; and (2) non-metallic spheres. The The high thermal resistance of the multiple-contact supports arises from the numerous relatively poor contacts between the individual plates. Some special treatments of the plates were tried, and two of these, perforating and dusting, were found to be effective. Pyrex-glass spheres were also found to be excellent insulators, but, of course, are not as rugged as a stack of metal plates. Of the untreated plates tested, those of stainless steel (0.0008 inch thick) were found to be the best insulators per unit length of stack. The heat conduction through these plates, at a load pressure of 1,000 pounds per square inch, was found to be 2 percent of the conduction by a solid sample of the same metal having the same dimensions. Author

N70-38276# Massachusetts Inst. of Tech., Cambridge.
THERMAL CONDUCTIVITY OF GASES. 1: THE COAXIAL CYLINDER CELL
Leslie A. Guildner *In* NBS Precision Meas. and Calibration Feb. 1970 p 317-324 refs Submitted for publication (See N70-38251 21-33)
(Contract Nonr-1858(25); Proj. SQUID)
Avail: SOD $5.00

By combining appropriate geometric configuration and mathematical analysis with improved measuring techniques, the cell constant of a coaxial cylinder thermal conductivity cell was determined within 0.1 percent. An analysis of the rate of heat transfer in such a cell showed a way to treat the data so that the error contribution of experimental deviations from idealized conditions is kept small. The principal considerations are: (1) the heat transport by convection is significantly large in a dense gas. This transport was analyzed mathematically from basic principles. The agreement of experimental results with the analysis indicated that the expressions are valid and that the convective heat transport could be accounted for with little more error than was involved in the

precision of the heat transfer measurements; (2) that the heat transfer in a vacuum corresponds to the heat transfer by radiation and solid contacts in the presence of gas. The uncertainty was that associated with the accuracy of determining the vacuum values; and (3) that other effects were small enough to be computed and corrected for without increasing the uncertainty of the values of the thermal conductivity. Author

N70-38277# National Bureau of Standards, Washington, D.C.
A RADIAL-FLOW APPARATUS FOR DETERMINING THE THERMAL CONDUCTIVITY OF LOOSE-FILL INSULATIONS TO HIGH TEMPERATURES
D. R. Flynn *In its* Precision Meas. and Calibration Feb. 1970 p 325 - 333 refs Submitted for publication (See N70-38251 21-33)
Avail: SOD $5.00

A description is given of an apparatus used for determining the thermal conductivities of loose-fill granular materials in the temperature range 100 to 1,100 C. The method used in making these determinations was that of radial heat flow through a hollow cylinder of specimen material contained between a central ceramic core and an outer ceramic shell. The heat flow through the specimen was determined by measurement of the power input to a heater in the central ceramic core. The radial temperature drop through the specimen was inferred from temperatures measured in the core and in the shell, thus avoiding entirely mental results with an estimated uncertainty of 3 percent or less are presented for diatomaceous earth having a density of 0.15 g/cu cm, and for aluminum oxide powders having densities of 0.40 and 0.44 g/cu cm. A discussion of the test method is given, with attention to possible sources of error. Author

N70-38377*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO ABLATOR THERMAL PERFORMANCE AT SUPERORBITAL ENTRY VELOCITIES
Donald M. Curry and Emily W. Stephens Washington Sep. 1970 27 p refs
(NASA-TN-D-5969; MSC-S-247) Avail: CFSTI CSCL 20M

Objectives of the Apollo 4 and 6 missions included the demonstration of the capability of the ablative heat shield to survive entry at lunar-return velocities and the collection of data necessary to support the analytical qualification of the ablative heat shield for manned lunar-return missions. Results of ground test programs, as well as the Apollo 4 and 6 flight tests, are discussed in relation to the verification of the analytical ablation model. Ablator cores taken from the Apollo command module were evaluated to obtain the thermophysical property values used in the analytical model. Temperatures were measured by thermocouples located in depth in the ablator. Char-thickness measurements were obtained from char sensors in the heat shield and from ablator cores. The results of the thermal performance evaluation and comparisons of measured and predicted data were used to establish a confidence level in the analytical model used to make preflight predictions and will provide the information necessary to improve prediction techniques. Author

N70-38451# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst
THE VISCOELASTIC POTENTIAL AND ITS THERMODYNAMIC FOUNDATIONS
K. C. Valanis [1969] 39 p refs
(Grant NSF GK-748)
(BULL-52) Avail: Issuing Activity $2.00

Onsager's theory on the thermodynamics of viscoelastic materials was critically reevaluated. Theorems, corollaries, and proofs using the constitutive equations are given. The results of the reevaluation establish the existence of a viscoelastic potential from which the stress tensor and entropy density are derivable. E.H.W.

N70-38551 Michigan Univ., Ann Arbor.
A STUDY OF FILM BOILING ON A HORIZONTAL PLATE
Yan-Jeong Lao (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-18047

An investigation of film boiling heat transfer on a horizontal plate from both a fundamental and phenomenological viewpoint was conducted. Experimental results were obtained from Freon-11. The basic ideas of the theoretical analysis are that the liquid layer possesses a net upward momentum during bubble formation which is due to the rise in mean level of this layer, and that the pressure in the vapor film is uniform. A momentum balance is made between the vapor and the liquid resulting in a prediction of the most probable wavelength which is checked by the experimental results of this investigation. A correlation procedure is established based upon a physical model utilizing a forced convection approach. The heat transfer in film boiling is related to a modified Stanton number and vapor film Reynolds number by an analysis similar to that for convective heat transfer between two flat plates. The resultant correlation represents the available data for film boiling of organic liquids and water with considerable success. Dissert. Abstr.

N70-38578# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Siebersdorf (Austria). Inst. fuer Reaktortechnik.
THE TRANSFER FUNCTION OF A HEAT EXCHANGER. COMPARISON OF DIFFERENT MODELS [DIE UBERTRAGUNGSFUNKTION DES WAERMETAUSCHERS VERGLEICH DER VERSCHIEDENEN MODELLE]
H. Schmidl Apr. Apr. 1970 24 p refs In GERMAN Submitted for publication
(SGAE-RT-32/1970) Avail: CFSTI

General dynamic models for heat exchange are compared with heat exchange processes that allow for axial heat transfer. The axial heat flux is described by turbulent heat conduction values composed from temperature data of laminar and turbulent fluid flow. An example calculation for pipe flow of 100 C water at 10 atu establishes the dependence of measured values on the Re-number. Transl. by G.G.

N70-38612# Joint Publications Research Service, New York.
HIGH TEMPERATURE THERMODYNAMICS OF URANIUM CARBIDES
S. S. Nikolskiy et al 21 Aug. 1970 18 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (USSR), v. 7, no. 5, 1969 p 873 - 876
(JPRS-51221) Avail: CFSTI

Equations are proposed with four parameters for describing the activities of uranium and carbon as functions of the composition of the cubic solid solution. These equations correspond to a nonideal solution consisting of the substances U, UC and UC2 between which the reversible reaction UC2 + U yields 2UC takes place. Author

N70-38635# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF GAS FLAME THEORY
L. A. Vulis et al 27 Mar. 1970 235 p refs Transl. into ENGLISH from the Russian
(AD-706646; FTD-HT-23-401-69) Avail: CFSTI CSCL 21/2

Principles of aerodynamic theory and methods of calculating gas jets are covered in this monograph. Problems of the flow structure, turbulent combustion of nonmixed gases, and thermal

regimes of flames are discussed. Some special problems are reviewed dealing with high velocity combustion and flame interaction with an electromagnetic field. The monograph is intended for engineers dealing with thermal physics, power engineering, and mechanical engineering. It may also be of use to postgraduate students and students specializing in thermal physics and heat engineering. Author (TAB)

N70-38724# Research Inst. of National Defence, Stockholm (Sweden).
THERMAL RADIATION FRONT FROM A POINT EXPLOSION
N. Hoernqvist Oct. 1969 21 p refs
(FOA-4-C-4402-23(25)) Avail: AEC Depository Libraries

The propagation of thermal radiation from a point explosion is considered, using the radiation diffusion approximation. The existence of a sharp forward boundary, representing a radiative front, is demonstrated by the exact solutions to the one-dimensional plane in cylindrical and spherical cases. Author (NSA)

N70-38925 National Lending Library for Science and Technology, Boston, Spa (England).
HEAT LOSSES OF HEATED BURIED PIPES
G. Franz et al 2 Apr. 1970 17 p Transl. into ENGLISH from Waerme und Stoffuebertrag. (West Germany), v. 2, no. 2, 1969 p 109 - 117
(NLL-CE-Trans-5315-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An electric analog (conductive-sheet analog) is described for the determination of heat losses and temperature distribution of pipes embedded in a layer of insulating material in the ground. Peculiarities of the conductive detail. For the simplified case of two tubes uninsulated in the ground, possibilities of calculation or approximation of heat losses and temperature-distribution are investigated. In many cases good agreement is obtained between prediction and experimental results. In any case the heat losses of the steam-pipe show a distinct minimum, depending on the distance between the pipes. This can be explained using the plots of the isotherms. Author

N70-38962 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL STUDIES OF LOCAL HEAT TRANSFER COEFFICIENTS IN A CIRCULAR CHANNEL AND THE INFLUENCE OF ECCENTRICITIES ON THE TEMPERATURE DISTRIBUTION
V. Suelc 1970 87 p refs Transl. into ENGLISH from German report KFK-tr-288 In ENGLISH and GERMAN
(NLL-WINDSCALE-Trans-418(9091.9F); KFK-tr-288) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

The effect of eccentrically arranged fuel elements in a flow channel on reactor design is investigated. Distortion or bending of the fuel element relative to the channel axis and a resultant increase in temperature on the element wall may cause reactor damage. The local heat transfer coefficient was determined as a function of eccentricity in the measurement range. The temperature distributions in the wall and in the sodium were derived for the whole channel from the measured temperatures and on the basis of an analysis of the hydraulic conditions. The results show that a deviation of the fuel element from the channel axis produces considerable temperature variations on the surface of the heating element and in the sodium, in contrast with relatively small variations in the local heat transfer coefficient. Author

N70-38966 National Lending Library for Science and Technology, Boston Spa (England).
THE PROPAGATION OF AN EXPLOSION IN THIN LAYERS OF SOLID EXPLOSIVES
V. K. Bobolev et al 24 Jun. 1970 14 p Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 5, pt. 3, Sep. 1969 p 331 - 337 In ENGLISH and RUSSIAN
(NLL-M-9189(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Experiments were conducted to determine the development process of an explosion in thin layers of solid high-density explosives. Results of the experiments indicate the following: (1) In the localized initiation of a thin layer of explosive placed under stress between stable surfaces, explosion development begins as fairly slow combustion. (2) The gaseous decomposition products evolved during combustion sharply increase the pressure within the bulk of the reacted substance. (3) The rise in pressure serves to enforce the penetration of the combustion products into any material that has not been enveloped by the decomposition reaction and its ignition. (4) The combustion products move away from the initiation center in pursuit of the accelerating flame front and act like a piston to form a compression wave ahead of themselves. (5) During deformation of the explosive, centers of reaction are formed in the zone subjected to wave compression, and the formation of these centers is the condition which determines whether further propagation of the explosion is possible. D.L.G.

N70-38982 National Lending Library for Science and Technology, Boston Spa (England).
THE INITIATION AND DEVELOPMENT OF A DETONATION EFFECTED IN LIQUID EXPLOSIVES BY WEAK SHOCK WAVES
A. V. Dubovik et al 24 Jun. 1970 14 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 5, pt. 3, Sep. 1969 p 354 - 361 In ENGLISH and RUSSIAN
(NLL-M-9190-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

This exposition shows how important it is to take account of a temporary physical state in any analysis dealing with liquid explosives. If, in single homogeneous compression, the initiation pressures for liquid explosives are high, 60 to 120 kbar, then when there is cavitation, the same liquids are explodad by application of comparatively small pressures and in their sensitivity to the action of shock waves approach the powdery state of the explosive. When the charge has an appropriate casing, acting as conductor for elastic disturbances, the development of an explosion in liquids leads to the generation of a detonation with low velocity which can subsequently pass into a normal detonation. The propagation of low velocity systems in liquids becomes very similar to the propagation of detonations with low velocity in solid powdery explosives. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-37604# Oak Ridge National Lab., Tenn.
THE OAK RIDGE NATIONAL LABORATORY KWIC INDEX
G. K. Haeuslein and Ann S. Klein May 1970 37 p refs
(Contract W-7405-eng-26)
(ORNL-4536) Avail: CFSTI

The ORNL KWIC index offers a wide choice of options. The report describes the input formats, the control card options, and the program setup. Author

N70-37777# Hebrew Univ., Jerusalem (Israel). Applied Logic Branch.
DEEP STRUCTURES, MODEL SETS AND

PRESUPPOSITIONS
Moshe Kroy Jan. 1970 41 p refs
(Contract F61052-68-C-0036)
(AD-706878; AFOSR-70-1538TR; SR-3) Avail: CFSTI CSCL 5/7

A theory of the process of identification of presuppositions underlying the happiness of usage of sentences in natural languages is sketched and applied. Theoretical background including Chomsky's conception of grammar and Hintikka's modal - set - theory are reviewed. Outlines of a non - Katz type of semantics are suggested. Author (TAB)

N70-37926# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
UCLA MOTOR VEHICLE SAFETY CONTRACT Final Report, 1 Oct. 1968 - 30 Sep. 1969
C. Starr and M. A. Greenfield Sep. 1969 510 p refs
(Contract FH-11-6690)
(Rept-69-51) Avail: Issuing Activity

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1. COLLISION INVESTIGATION CASE COLLECTION A. W. Siegel p 3 - 25 (See N70-37927 21-34)
2. DEVELOPMENT OF A TRAINING PROGRAM FOR MEDICAL ENGINEERING TEAMS A. W. Siegel p 29 - 33 (See N70-37928 21-05)
3. COLLISION CASE ABSTRACTS p 39 - 79 (See N70-37929 21-34)
4. TRAUMA RESEARCH GROUP SPECIAL STUDY SHORT FORM p 80 - 84
5. GENERAL MOTORS "COLLISION PERFORMANCE AND INJURY REPORT" (1969) LONG FORM p 85 - 87
6. DEFORMATION INDEX STUDY Arnold W. Wiegel p 89 - 110 refs
7. MEDICAL ASPECTS: CASUALTY - FATALITY INDICES p 117 - 127
8. MEDICAL ASPECTS: ORANGE COUNTY CORONER'S OFFICE p 131 - 134
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11. LETTER FOR MEDICAL DATA ACQUISITION p 147 - 149
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20. THORACIC IMPACT: THE STATIC AND DYNAMIC BEHAVIOR OF THE HUMAN THORACIC SKELETON S. B. Roberts p 283 - 302 (See N70-37930 21-04)
21. CARDIOVASCULAR IMPACT: AORTA RUPTURE R. Collins p 303 - 342 refs (See N70-37931 21-04)
22. MECHANICAL CHARACTERIZATION OF HUMAN TISSUE R. A. Westmann p 343 - 371 refs (See N70-37932 21-04)
23. HEAD S. B. Roberts p 373 - 417 refs (See N70-37933 21-04)
24. NEUROLOGIC STUDIES A. M. Nahum p 419 - 421 (See N70-37933 21-04)
25. VEHICLE STRUCTURE RESPONSE: DYNAMIC ANALYSIS OF AUTOMOTIVE STRUCTURAL SYSTEMS L. Selna and D. Salinas p 423 - 445 refs (See N70-37935 21-32)
26. AUTOMOBILE ACCIDENT RECONSTRUCTION R. I. Emori p 447 - 467 refs (See N70-37936 21-34)
27. DYNAMIC PHOTOELASTIC STUDIES L. P. Felton p 469 - 486 refs (See N70-37937 21-32)

N70-37927# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
COLLISION INVESTIGATION CASE COLLECTION
A. W. Siegel *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 3 - 25 (See N70-37926 21-34)
Avail: Issuing Activity

The trauma research group was able to complete and submit 40 vehicle collision analysis cases to the National Highway Safety Bureau. These cases dealt mainly with current model passenger vehicles, major bus collisions and truck collisions. A few cases involving older vehicles were submitted when the circumstances of the collision and subsequent injuries could be applied to current vehicles. Additional studies were designed to provide information or develop techniques in areas needed by the investigators for complete collision case analysis. Case collision and reporting systems were updated and case selection criteria modified. Author

N70-37929# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
COLLISION CASE ABSTRACTS
In its UCLA Motor Vehicle Safety Contract Sep. 1969 p 39 - 79 (See N70-37926 21-34)
Avail: Issuing Activity

This collection of automobile collision case abstracts emphasized occupant kinematics during impact, sustained crash injuries, and medical histories. Injury causing translational motions of automobile parts are also described. G.G.

N70-37936# University of Southern Calif., Los Angeles. Schools of Engineering and Medicine.
AUTOMOBILE ACCIDENT RECONSTRUCTION
R. I. Emori *In its* UCLA Motor Vehicle Safety Contract Sep. 1969 p 447 - 467 refs (See N70-37926 21-34)
Avail: Issuing Activity

In order to use automobile accidents as controlled experiments with humans, and to translate accident-produced information into safety design, an engineered method of reconstructing vehicle motion during accidents from post-accident evidence, such as automobile body deformation, tire skid marks, and final position of the vehicle is pursued. Analytical and experimental methods have been followed. Similitude and model study have confirmed rigid-body treatment of vehicle bodies during and after collision. Hence, the major portion of the experimental approach is relieved of full-size collision tests as far as reconstruction is concerned, and the analytical approach is drastically simplified because similitude confirmed that rigid-body dynamics are appropriate to computation. A computer program has been generated for the calculation of post-collision vehicle trajectories. The computer results show good agreement with the experiments. For a more accurate reproduction of the accident a parametric study is being followed in the computation in an effort to obtain a priority list of items observed at the accident site. Author

N70-38106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCELERATOR OF TECHNICAL PROGRESS
O. Kremnev 23 Jan. 1970 8 p Transl. into ENGLISH from Pravda (Moscow), 17 Sep. 1969 p 3
(AD-706177; FTD-HT-23-616-69) Avail: CFSTI CSCL 5/2

The article discusses the relation of scientific research institutes in the USSR and Ukrainian SSR with industrial and commercial enterprises. It reviews the progress and certain problems of introducing scientific and research achievements to industry. It discusses funding problems for certain research and advises closer contact between science and industry. Author (TAB)

N70-38134# Stanford Univ., Calif. Electronics Labs.
[PLASMA PHYSICS, QUANTUM AND SOLID STATE ELECTRONICS, RADIOSCIENCE, AND INFORMATION AND

DIGITAL SYSTEMS] Quarterly Status Report, 1 Jan. – 31 Mar. 1970
31 Mar. 1970 140 p refs
(Contract N00014-67-A-0112-0044)
(AD-707500; SU-SEL-70-011; QSR-117) Avail: CFSTI CSCL 20/9

Contents: Plasma physics and quantum electronics; Radioscience; Solid-state electronics; Information systems; Digital systems. TAB

N70-38154# Hebrew Univ., Jerusalem (Israel). Applied Logic Branch.
APPLICATIONS OF EPISTEMIC LOGIC TO THE PHILOSOPHY OF SCIENCE
Moshe Kroy Feb. 1970 37 p refs
(Contract F61052-68-C-0036)
(AD-706879; AFOSR-70-1539TR; SR-7) Avail: CFSTI CSCL 5/6

The paper reviews Hintikka's Epistemic Logic, mainly with respect to technical aspects and to that part of the system that deals with the combination of epistemic notions and the concepts of the propositional calculus. Extensions are made to combinations of epistemic operators with alethic predicates and quantification over statements. An epistemic conceptual framework for inductive logic is outlined and applied to the explication of 'analytic' as a pragmatic concept. The research contributes to theories for natural language analysis. TAB

N70-38175# Case Western Reserve Univ., Cleveland, Ohio. Systems Research Center.
RESEARCH ABSTRACTS
Dec. 1969 67 p refs
(AD-706933) Avail: CFSTI CSCL 12/2

Brief summaries are given of theoretical and applied research projects in the systems area which were in process at the CWRU System Research Center during 1968-69. A list of publications resulting from the work is included. TAB

N70-38374# Naval Research Lab., Washington, D.C.
NAVAL RESEARCH LABORATORY, WASHINGTON Annual Report, 1969
1969 157 p refs
(AD-706718) Avail: CFSTI CSCL 5/2

Contents: Electronics; Materials; General sciences; Oceanology. TAB

N70-38493# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP, JANUARY 1970
Jan. 1970 48 p refs
(AGARD-Bull-70-1) Avail: CFSTI

An outline is given of the 1970 panel meeting topics and their calendar dates for each of the following panels: aerospace medicine, avionics, electromagnetic wave propagation, flight mechanics, fluid dynamics, guidance and control, propulsion and energetics, structures and materials, technical information, research and development, and consultant and exchange program. A list of the 1969 publications issued in each field is presented, with accompanying abstracts. Panel membership lists are included. P.A.B.

N70-38541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENT OF DEVELOPMENT OF INFORMATION RETRIEVAL LANGUAGE IN SECTIONS OF TECHNICAL INFORMATION AT ENTERPRISES AND IN ORGANIZATIONS
Yu. L. Pokras 1 Apr. 1970 24 p Transl. into ENGLISH from Russian Rept.
(AD-706351; FTD-MT-24-30-70) Avail: CFSTI CSCL 5/2

The various aspects of information service work at R and D bodies are considered, and the Reference Files of a developmental body are characterized. From a study of information requests, a user analysis is attempted. The necessity and possibility is argued of developing a common information-retrieval language for the plants information service. Methods of IRL preparation are reviewed, and main problems in creating and implementing it are given. Analyzed are the vocabulary, structure and use of IRL. A view of future work is presented. Author (TAB)

N70-38618# National Science Foundation, Washington, D.C.
GUIDE TO PROGRAMS
Jun. 1970 83 p
(NSF-70-14) Avail: SOD $0.75

The areas in which the National Science Foundation awards grants to support research are listed as biological and medical sciences, engineering, mathematical and physical science, social sciences, and environmental sciences. The foundation considers all proposals for support regardless of source, and the policy is to emphasize graduate and postdoctoral education. The eligibility criteria are given for each research program. F.O.S.

N70-38647# Congress. House. Committee on Science and Astronautics.
A TECHNOLOGY ASSESSMENT SYSTEM FOR THE EXECUTIVE BRANCH Report of the National Academy of Public Administration
Washington GPO Jul. 1970 93 p refs Prepared by the Natl. Acad. of Public Admin. for the Subcomm. on Sci., Res., and Develop.
Avail: SOD $0.45

Recommendations are presented for procedures to be followed by the Executive branch of government in technology assessment. The investigation was made with respect to public administration and possible application to organizational and administrative formats in the Executive branch. R.B.

N70-38648# Battelle Inst., Frankfurt am Main (West Germany).
BATTELLE INFORMATION NUMBER 3
Jan. 1969 47 p refs
Avail: CFSTI

CONTENTS:
1. MICROFILAMENTS J. Nixdorf and H. Rochow p 4–16 refs (See N70-38649 21-17)
2. EXPLOSIVE CLADDING OF METALS W. Geiger, K.-H. Schramm, and W. Wolf p 17–18 (See N70-38650 21-17)
3. REPORTS FROM THE DEPARTMENTS p 19–32
4. GROUP PROJECTS p 33–45

N70-38668# Rhode Island Univ., Kingston. Law of the Sea Inst.
THE LAW OF THE SEA: NATIONAL POLICY RECOMMENDATIONS Technical Report, 31 Mar. 1969–31 Mar. 1970
Lewis M. Alexander Apr. 1970 543 p refs Proc. of the Ann. Conf. (4th) of the Law of the Sea Inst., Kingston, Rhode Island, 23-26 Jun. 1969
(AD-706075) Copyright. Avail: CFSTI CSCL 5/4

The volume contains nineteen professional papers, critiques of several of these, shorter articles by panel participants, and verbatim discussions covering the four-day conference. The program centered primarily about the international policy recommendations of the Marine Science Commission, and was broken down into the

following major sub-headings: the deep-seabed and continental shelf; fisheries arrangements; and freedom of scientific inquiry. There were also sessions on offshore boundaries and boundary determination, and on ocean strategy for the United States. Among the contributed papers in the volume are one on the Malta Plan and the United Nations, and another on Mathematical economics and Marine Resources Research. Author (TAB)

N70-38714*# Syracuse Univ., N.Y.
RELATIONSHIPS BETWEEN RESEARCH AND DEVELOPMENT OPERATIONS AND INDUSTRIAL OPERATIONS AT MSFC
Bernard D. Wood Presented at an Interdisciplinary Seminar, Syracuse, N.Y., 16 Apr. 1969 *Its* Working Paper No. 19
(Grant NGL-33-022-090)
(NASA-CR-109153) Avail: CFSTI CSCL 05A

An attempt is made to explain the complex relationships, both formal and informal, between the two directorates at the MSFC as they existed prior to the reorganization of February, 1969. Through a detailed expansion of selected sections of the official organization chart, a typical interaction between a sub-system manager in IO and a particular section of one laboratory in R and DO was examined. The formal channels, the management matrices, and the modes of informal contact were reviewed from results of numerous interviews. The change board and the management levels throughout the Apollo program were also examined. Author

N70-38736# Saclant ASW Research Center, La Spezia (Italy).
OPTIMUM THEORETICAL STRUCTURES OF SONAR SYSTEMS EMPLOYING SPATIALLY-DISTRIBUTED RECEIVING ELEMENTS
F. Bryn 1 Sep. 1968 50 p refs Presented at the NATO Advan. Study Inst. on Signal Process., Enschede, Neth., 12 - 23 Aug. 1968
(Saclantcen-TR-119) Avail: CFSTI

The active systems considered operate in the presence of a time-variable noise field and in a randomly-varying transmission medium. The noise-dependent signal processor is studied with special emphasis on structures that can adapt themselves to a time-varying noise field. The signal-dependent signal processor is derived for some simple types of random signal distortion. The signal characteristics required for the instrumentation of such processors are related to the impulse response of the target-medium combination. Author (ESRO)

N70-38755# Dayton Univ., Ohio. Research Inst.
USER APPRAISAL AND COST ANALYSIS OF THE AEROSPACE MATERIALS INFORMATION CENTER Final Summary Report, 1 Dec. 1968 - 30 Nov. 1969
Frederick L. Scheffler and Jacqueline F. March Wright-Patterson AFB, Ohio AFML Jan. 1970 103 p refs
(Contracts F33615-69-C-1128; AF 33(615)-3389)
(AD-707143; AFML-TR-70-27) Avail: CFSTI CSCL 5/2

An evaluation study was performed for the Aerospace Materials Information Center document retrieval system. Both system performance and economic criteria were established. Analysis of responses indicated that the AMIC system compares favorably with other information centers with regard to providing pertinent materials with a sufficiently rapid response. Results showed a wide interest in special types of documents as well as the technical reports. State-of-the-art, symposium proceedings, bibliographies handbooks, trade literature and computer programs were indicated as being of high interest. The respondents indicated a fairly high dependence on information services, both within their own organization and outside information services. Cost figures for the past four years show that by far the major cost item is the input of documents into the system. The average cost per document including all clerical and professional effort and overhead has averaged about $10 per item. The cost of searches has varied from $33 to $49 per search including computer time, professional time and clerical time and overhead. Much of the variation in cost can be attributed to the degree of batching of searches. Certain modifications were incorporated into the AMIC system, primarily in response to respondents to the evaluation form. Author (TAB)

N70-38785# Congress. House. Committee on Appropriations.
INDEPENDENT OFFICES AND DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT APPROPRIATIONS, 1971 Message from the President of the United States, Returning, Without Approval, Act H.R. 17548
Washington GPO 11 Aug. 1970 28 p Presented to the 91st Congr., 2d Sess., 11 Aug. 1970
(H-Doc-91-377) Avail: US Capitol, House Document Room

An appropriations bill passed by Congress for various independent executive bureaus, boards, commissions, corporations, agencies, offices, and the Department of Housing and Urban Development is reported. The bill is accompanied by a message from the President stating the reasons for disapproval. R.B.

N70-38837 National Lending Library for Science and Technology, Boston Spa (England).
UKRAINE DEVELOPS SOCIAL SCIENCES
I. Beloded 24 Jun. 1970 4 p Transl. into ENGLISH from Pravda Ukrainy, 10 Oct. 1969
(NLL-M-9235-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Outlined are increased activities and new establishments dealing with social sciences in addition to the existing institutes of economy, history, philosophy, archeology, etc. Ukrainian sociologists researched: (1) social aspects of economic reform in industry; (2) theoretical fundamentals of management and its connection with the economic independence of enterprises; (3) economic conditions and factors accelerating technical progress; (4) issues of dialectic and historical materialism; (5) space laws; (6) West European and American literature; (7) structural and mathematical linguistics; and (8) bourgeois ideological concepts. G.G.

N70-38867# Committee on Science and Astronautics.
FOR THE BENEFIT OF ALL MANKIND: A SURVEY OF THE PRACTICAL RETURNS FROM SPACE INVESTMENT
Washington GPO 1970 66 p refs Presented by the Comm. on Sci. and Astronautics at the 91st Congr., 2d Sess., 14 Sep. 1970 *Its* Serial R
(Rept-91-1446) Avail: Comm. on Sci. and Astronautics

Current and near-future peaceful benefits to mankind are recapitulated. Approximately ninety benefits are cited with applications to communication systems, weather forecasting, business technologies, management procedures, medical research, education, and equipment and materials for both home and market use. Future benefits cited include those in agriculture, improved communication systems, space hospitals for heart patients, pollution control, and application of television cameras to enable the blind to see. E.H.W.

N70-38876# Battelle Inst., Frankfurt am Main (West Germany).
BATTELLE INFORMATION NUMBER 1
Mar. 1968 49 p
Avail: CFSTI

CONTENTS:

1. THE LASER AND ITS APPLICATION K. Guers p 6 - 19 (See N70-38877 21-16)
2. ELECTRONIC DATA BANK THE MODERN INFORMATION CENTRE Felix-Dieter Breunig p 20 - 21
3. THE IMPORTANCE OF UNCONVENTIONAL METHODS OF ENERGY CONVERSION FOR DEVELOPING COUNTRIES K. Altfelder p 22 - 23 (See N70-38878 21-34)

4. REPORTS FROM THE DEPARTMENTS p 24 - 45
5. INDUSTRIAL COLLOQUIA p 46 - 48

N70-38878# Battelle Inst., Frankfurt am Main (West Germany).
THE IMPORTANCE OF UNCONVENTIONAL METHODS OF ENERGY CONVERSION FOR DEVELOPING COUNTRIES
Klaus Altfelder *In its* Battelle Inform. No. 1 Mar. 1968 p 22 - 23 (See N70-38876 21-34)
Avail: CFSTI

This report discusses the use of nuclear, solar, wind and geothermal power for generating electric power in the 50 - 1000 kW range in developing countries. ESRO

N70-38951# Congress. Senate. Committee on Aeronautical and Space Sciences.
CONGRESSIONAL RECOGNITION OF GODDARD ROCKET AND SPACE MUSEUM, ROSWELL, NEW MEXICO
Washington GPO 1970 108 p refs Presented at Comm. on Aeronautical and Space Sci., 91st Congr., 2d Sess., Mar. 1970 (S-Doc-91-71) Avail: Comm. on Aeronautical and Space Sci.

Testimony and prepared statements are documented honoring Dr. Robert H. Goddard and supporting Senate Concurrent Resolution 49 to provide congressional recognition of the Goddard Rocket and Space Museum. E.C.

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NEW NASA PUBLICATIONS

Aerospace Food Technology (NASA SP–202)

The proceedings of a conference, sponsored by the National Aeronautics and Space Administration and the National Academy of Sciences, and held at the University of South Florida, April 15–17, 1969. The meeting concerned itself with the state-of-the-art of advanced food technology as it might be applicable to future aerospace missions. *Paperbound.* 224 pp. Available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

Spacecraft Earth Horizon Sensors (NASA SP–8033)

A NASA design criteria monograph in the series on guidance and control, containing recommendations for the design of infrared Earth horizon sensors to be used on orbiting spacecraft. *Paperbound.* 48 pp. Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

Wind Loads During Ascent (NASA SP–8035)

A new NASA design criteria monograph in the series on structures. This publication treats the determination of wind-induced structural loads on a space vehicle during ascent. In particular, models of the wind environment are described and analytical procedures outlined for using these models with the space vehicle properties and trajectory parameters in order to calculate the loads induced by winds. The wind models are synthesized from measured natural wind-environment data, and these data—available for each of the four major launch sites used by NASA—are referenced. *Paperbound.* 40 pp. Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

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